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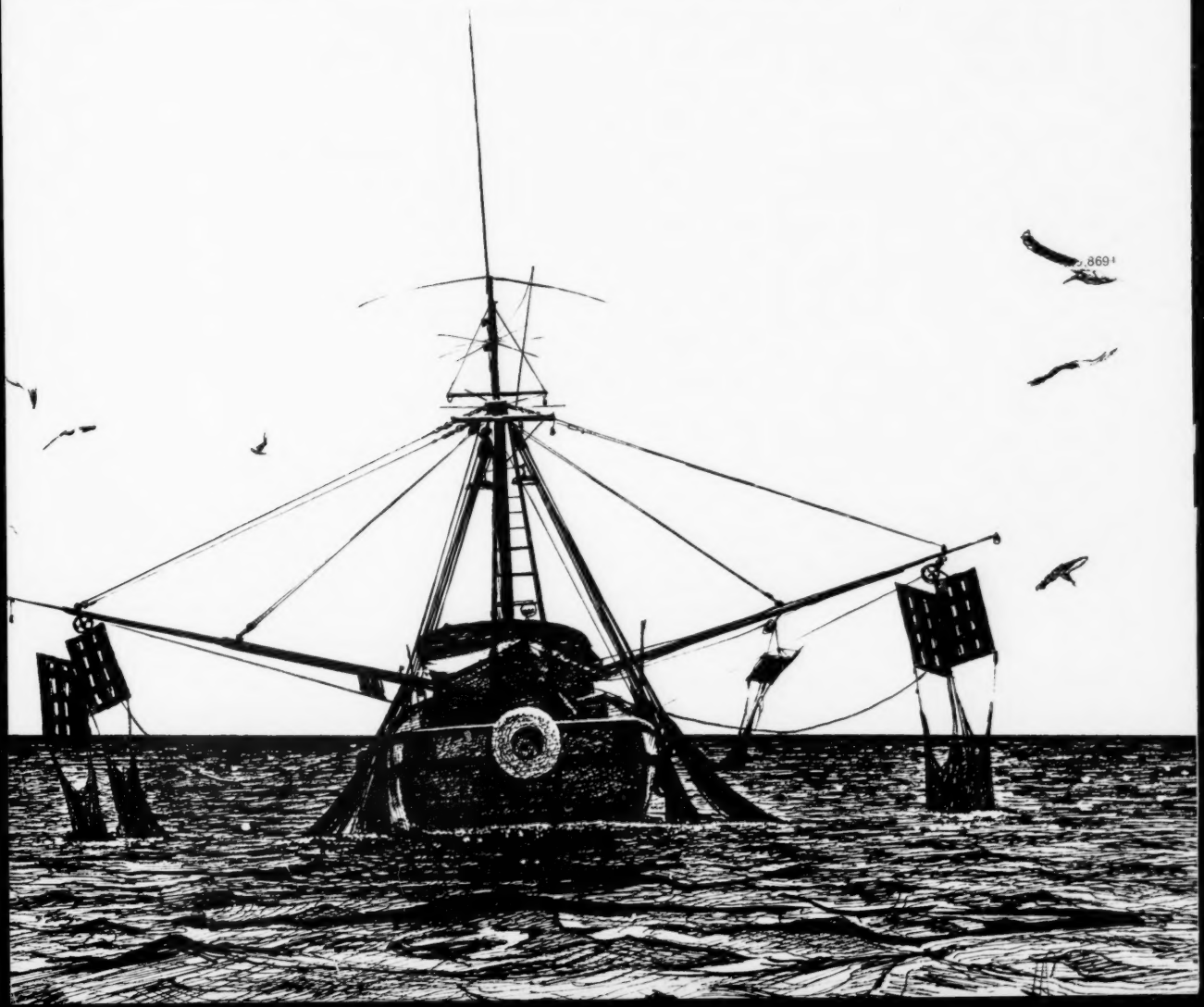

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MFR PAPER 1104

Estimated Costs, Returns, and Financial Analysis: Gulf of Mexico Shrimp Vessels

WADE L. GRIFFIN, RONALD D. LACEWELL, and WAYNE A.HAYENGA

INTRODUCTION

This report results from an economic evaluation of shrimp landings in the Gulf of Mexico based on data available from the National Marine Fisheries Service and is intended for financial institutions, shrimp vessel owners, and prospective shrimp vessel owners. The first part of this report indicates costs and returns of shrimp vessels in 1971. The second part is an investment analysis including cash flow and rate of return on a shrimp vessel entering the Gulf shrimping fleet. The last section reflects cost changes in the base 1971 data to account for cost levels experienced in early 1974.

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BUDGET ANALYSIS

Costs and returns for two shrimp vessel classifications based on length of vessel are compared on both annual cost and return basis and on the basis of cost per pound of shrimp landed. Annual cost and return estimates are presented in Table 1 and are based on 1971 data taken from 29 vessels in two classes, 53- to 65-foot and 66- to 72-foot. The average vessel in the 53- to 65-foot class landed 41,551 pounds of shrimp, which sold at nearly $1.13 per pound, yielding a gross revenue of $46,800. Variable costs to land these shrimp were $30,031. The largest variable cost items were crew and captain shares ($16,380), repairs and maintenance ($5,728), and fuel ($3,148). This left $16,769 income above variable costs. Annualized fixed costs based on 20-year vessel life, including depreciation, interest on investment and insurance, were $8,144, which resulted in total costs of $38,175 and net returns of $8,625.[1]

The 66- to 72-foot vessels landed more shrimp (56,933 pounds compared to 41,551 pounds) and received a higher price (nearly $1.23 compared to almost $1.13) than the smaller vessels. This higher price for shrimp for the larger vessels is due to their trawling in deeper water and landing larger shrimp. Gross returns for the larger vessel size were $69,869 in 1971. Variable costs were $51,632, which left $18,237 income above variable cost. However, the larger investment associated with the larger vessel resulted in an annual fixed cost of $10,421, which meant net returns for the 66- to 72-foot vessel were $7,816, or $809 less than for the 53- to 65-foot vessel.

Costs per pound of shrimp landed are estimated by taking total cost (by item) and dividing by the number of pounds landed. Table 2 indicates costs per pound of shrimp landed by the two vessel size classifications. Total variable costs for the 53- to 65-foot vessel were $0.72 per pound of shrimp landed. The crew and captain share was $0.39 per pound, repairs and maintenance $0.14, and fuel $0.08.

Fixed costs for the smaller vessels were $0.20 per pound of shrimp landed. Insurance was $0.08, interest cost just over $0.06 and depreciation just under $0.06. Total cost of a pound of shrimp landed in 1971 with a 53- to 65-foot vessel was about $0.92.

For a 66- to 72-foot vessel, variable costs per pound of shrimp were $0.91

Table 1.—Annual costs and returns for a typical Gulf of Mexico shrimp vessel, 1971.

Item	Vessel size 53-65 ft[1]	66-72 ft[2]
Gross receipts from production	$46,800[3]	$69,869[4]
Variable costs		
Ice	896	1,450
Fuel	3,148	7,107
Nets	704	680
Supplies	1,141	2,084
Electronics	662	1,028
Repair and maintenance	5,728	11,944
Packing	1,372	2,885
Shares	16,380	24,454
Subtotal	30,031	51,632
Income above variable costs	16,769	18,237
Fixed costs		
Depreciation	2,329	3,291
Insurance	3,152	3,697
Interest	2,663	3,433
Subtotal	8,144	10,421
Total costs	38,175	62,053
Net returns	8,625	7,816

[1]Data are from a sample of 8 vessels. Vessel life is based on 20 years and 2,500 fishing days. Straight line depreciation. Interest on investment based on an 8 percent annual rate. Captain and crew share is 35 percent of catch value.

[2]Data are from a sample of 21 vessels. Vessel life is based on 20 years and 2,500 fishing days. Straight line depreciation. Interest on investment based on an 8 percent annual rate. Captain and crew share is 35 percent of catch value.

[3]The 53- to 65-foot shrimp vessel landed an average 41,551 heads-off pounds of shrimp at an average price per pound of $1.126.

[4]The 66- to 72-foot shrimp vessel landed an average 56,933 heads-off pounds of shrimp at an average price per pound of $1.227.

[1]In establishing depreciation and interest charges, an investment of $56,584 is used for 53- to 65-foot vessels, and $75,820 for 66- to 72-foot vessels. In evaluating a particular vessel, the fixed costs should be recalculated using actual investment of the vessel.

Table 2.—Costs per pound of shrimp landed for a typical Gulf of Mexico shrimp vessel, 1971.

Item	Vessel size 53-65 ft[1]	66-72 ft[2]
Variable costs		
Ice	$0.0216	$0.0255
Fuel	0.0758	0.1248
Nets	0.0170	0.0119
Supplies	0.0275	0.0366
Electronics	0.0159	0.0181
Repair and maintenance	0.1379	0.2098
Packing	0.0330	0.0507
Shares[3]	0.3942	0.4295
Subtotal	0.7229	0.9069
Fixed costs		
Depreciation	0.0561	0.0578
Insurance	0.0758	0.0649
Interest[4]	0.0641	0.0603
Subtotal	0.1958	0.1830
Total costs[5]	0.9189	1.0899

[1]Based on 8 vessels and vessel life of 20 years.
[2]Based on 21 vessels and vessel life of 20 years.
[3]Crew and captain share is calculated as 35 percent of the value of the catch.
[4]Interest charge was calculated by (initial investment plus salvage divided by 2, and the result multiplied by 8 percent).
[5]Due to rounding off, the total may not equal a summation of all cost items.

and fixed costs were $0.18. Total cost per pound of shrimp landed was $1.09 for the 66- to 72-foot vessel, or $0.17 more than for the 53- to 65-foot vessel.

The average ex-vessel price of shrimp was $1.13 for the 53- to 65-foot vessel and $1.23 for the 66- to 72-foot vessel. Therefore, net revenue per pound of shrimp was $0.21 and $0.14 for the 53- to 65-foot and 66- to 72-foot vessels, respectively. The larger catch associated with the larger vessel resulted in total annual net returns being fairly comparable.

INVESTMENT ANALYSIS

Interviews with vessel builders indicated a typical 62-foot vessel costs about $72,000 fully rigged and ready to trawl. To trawl in deeper water and engage in longer trips, the initial investment for a vessel owner could increase to over $140,000. Such a vessel would be approximately 75 feet long and be equipped with a refrigeration unit.

In estimating the cash flow over the 20-year life of the vessel, two arrangements were investigated: (1) leveraged investment where the owner's investment was 20 percent of the purchase price and 80 percent was financed at 8 percent interest for 6 years, and (2) a situation in which the investment was equal to the purchase price. In both cases, an assumed $10,000 salvage value was included as income in year 20.

The annual cash flow data based on external financing are shown in Table 3 for the two vessel classifications. Annual cash flow to the owner of the 53- to 65-foot vessel in years 1 through 6 is $4,229, since $9,384 annual interest and loan repayment is deducted. However, after year 6, annual cash flow to the vessel owner increases to $13,613 and continues at this level through year 20. Vessel investment, based on a down payment of 20 percent of $56,584, would be $11,317. This means the payback period would be about 2.7 years.

For the 66- to 72-foot vessel, cash flow in years 1 through 6 is $1,797 and increases to $14,541 for years 7 through 20. For an investment of $15,164, the payback period would be an estimated 6.3 years.

Annual cash flow data without financing is presented in Table 4 for both vessel size classifications. This net cash flow to the vessel owner is an estimated $13,613 for a 53- to 65-foot vessel and $14,541 for a 66- to 72-foot vessel. Based on a purchase price of $56,584 for the smaller vessel, the payback period would be about 4.2 years. This is compared to 5.2 years for the larger vessel, which has an estimated purchase price of $75,820.

Table 3.—Investment analysis[1] for shrimp vessels using external financing, 1971 data.

Item	Vessel size 53-65 ft	66-72 ft
Annual cash flow summary		
Gross revenue	$46,800	$69,869
Cash operating expenses	33,187	55,328
Cash flow to owner for years 7-20[2]	13,613	14,541
Interest and loan repayment	9,384	12,744
Cash flow to owner for years 1-6[2]	4,229	1,797
Vessel owner investment[3]	11,317	15,164
Payback period	2.67 yr	6.30 yr

[1]This analysis is based on a leveraged investment of minimum down payment with external financing for the balance. A 20 percent down payment was assumed.
[2]The balance of the vessel purchase price (80 percent) is paid over a 6-year period and is deducted from owner returns. The $10,000 salvage value would also be income in year 20.
[3]Actual cash outlay for vessel purchase (investment) is 20 percent of purchase price.

Table 4.—Investment analysis for shrimp vessels[1] without external financing, 1971.

Item	Vessel size 53-65 ft	66-72 ft
Annual cash summary		
Gross revenue	$48,600	$69,869
Cash operating expenses	33,187	55,328
Net cash flow to owner[2]	13,613	14,541
Vessel owner investment	56,584	75,820
Payback period	4.16 yr	5.21 yr

[1]Based on a 20-year vessel life.
[2]The assumed value of $10,000 would also be added to income in year 20.

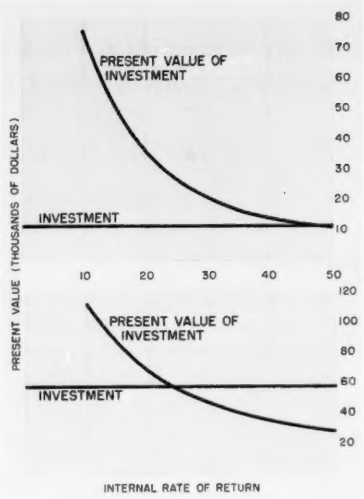

Figure 1.—Present value of expected stream of income for a 53- to 65-foot shrimp vessel at alternative discount rates assuming a 20-year operating life. External financing (top) of a shrimp vessel assumes 20 percent down and the balance financed for 6 years at 8 percent. Internal financing (bottom) assumes the owner pays the total vessel price at the time of purchase.

The data in Tables 3 and 4 provide the basis for a present value analysis. The present value of the stream of returns to the vessel owner is presented graphically in Figures 1 and 2 for small and large vessels, respectively, for any internal rate of return from 10 percent to 50 percent for an investment with and without financing. The rate of return on the investment is identified as that interest rate which equates the present value of the owner's net income stream to the owner's initial investment.

With external financing, the present value of the net cash flow generated by a 53- to 65-foot shrimp vessel (Fig. 1, top) is an estimated $75,000 at 10 percent, $50,000 at 15 percent, $35,000 at 20 percent, $20,000 at 30 percent, $14,000 at 40 percent, and $11,000 at 50 percent. Since the investment is an estimated $11,317, the internal rate of return would be just less than 50 percent. Therefore, if an investor's required rate of return

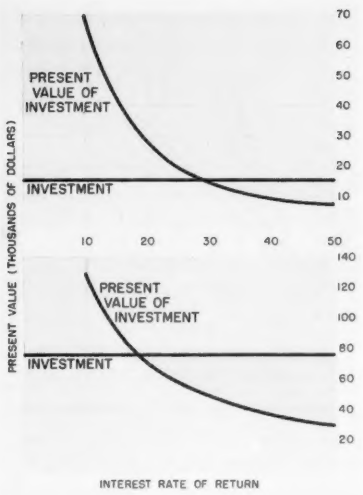

Figure 2.—Present value of expected stream of income for a 66- to 72-foot shrimp vessel at alternative discount rates assuming a 20-year operating life. External financing (top) of a shrimp vessel assumes 20 percent down and the balance financed for 6 years at 8 percent. Internal financing (bottom) assumes the owner pays the total vessel price at the time of purchase.

is less than the internal rate of return (50 percent in this case), the analysis indicates the investment would meet the return goals of the potential investor. With internal financing, Figure 1 (bottom) indicates that the internal rate of return is about 24 percent.

A similar present value analysis is presented in Figure 2 for 66- to 72-foot vessels. The internal rate of return with external financing is an estimated 30 percent. This is compared to 17 percent with total vessel price paid at the time of purchase. For both vessel size classifications, the rate of return on investment is higher using external financing. Comparing the two vessel classes, the internal rate of return is significantly larger for the 53- to 65-foot vessel using either type of financing.

Caution is advised in interpreting the present value analysis. First, the more risk involved in an investment, the larger the rate of return necessary to make a profitable investment. Second, the minimum internal rate of return required of an investment for a given risk level varies among investors. Lastly, this analysis is based on 1971 information. Shifts in shrimp catch or price, or in industry costs, will affect the results. For example, the addition of many vessels to the industry could be expected to reduce catch per vessel. These limitations should be kept in mind while reviewing the present value analysis presented.

Although the cash flow analysis used 1971 data and projected them for a 20-year period, it does provide a basis for considering investment in shrimp vessels. The reader is once again reminded of the sensitivity of the analysis to changes in catch, costs, and shrimp price. Also, the data are based on the assumption that the vessels are manned by experienced captains and crews. The vessel owner is vulnerable in that vessel performance is entirely dependent on the captain and crew. Therefore, the investor who is not intimately familiar with the shrimp industry is cautioned to study very carefully all the ramifications of vessel ownership prior to investment.

COSTS ADJUSTED TO SPRING 1974

The costs, returns, investment, and break-even analysis discussed up to this point refer to 1971 survey data. A preliminary survey conducted early in 1974 indicated that costs, other than fuel, increased by 19 percent since 1971. Fuel costs have increased twofold to threefold. To account for the upward shift in operating costs, the 1971 data were adjusted to show the break-even implications for shrimp vessels.

All costs except fuel and crew and captain shares were inflated 19 percent from 1971 levels. Fuel cost was

Table 5.—Annual costs and returns for a typical 53- to 65-foot Gulf of Mexico shrimp vessel, 1971 data adjusted to early 1974 conditions.

Item	1971		Estimated Spring 1974[1]	
	Actual	Break-even	Fuel cost doubled	Fuel cost tripled
Gross receipts from production[2]	$46,800	$33,530	$43,825	$48,668
Variable costs				
Fuel	3,148	3,148	6,296	9,444
Other	10,503	10,503	12,499	12,499
Shares[3]	16,380	11,735	15,339	17,034
Subtotal	$30,031	$25,386	$34,134	$38,977
Income above variable costs	16,769	8,144	9,691	9,691
Fixed costs	8,144	8,144	9,691	9,691
Total costs	38,175	33,530	43,825	48,668
Net returns	8,625	0	0	0
Actual price received per lb[4]	1.13			
Break-even price per lb[4]		0.81	1.05	1.17

[1]All variable costs except fuel and crew and captain shares were increased 19 percent.
[2]Based on annual catch of 41,551 pounds of head-off shrimp.
[3]Crew and captain shares are calculated as 35 percent of the value of the catch.
[4]Ex-vessel price per pound of heads-off shrimp.

Table 6.—Annual costs and returns for a typical 66- to 72-foot Gulf of Mexico shrimp vessel, 1971 data inflated to early 1974 conditions.

Item	1971		Estimated Spring 1974[1]	
	Actual	Break-even	Fuel cost doubled	Fuel cost tripled
Gross receipts from production[2]	$69,869	$57,845	$77,691	$88,625
Variable costs				
Fuel	7,107	7,107	14,214	21,321
Other	20,071	20,071	23,884	23,884
Shares[3]	24,454	20,246	27,192	31,919
Subtotal	$51,532	$47,424	$65,290	$76,224
Income above variable costs	18,237	10,421	12,401	12,401
Fixed costs	10,421	10,421	12,401	12,401
Total costs	62,053	57,845	77,691	88,625
Net returns	7,816	0	0	0
Actual price received per lb[4]	1.23			
Break-even price per lb[4]		1.02	1.36	1.56

[1]All variable costs except fuel and crew and captain shares were increased 19 percent.
[2]Based on annual catch of 56,933 pounds of heads-off shrimp.
[3]Crew and captain shares are calculated as 35 percent of the value of the catch.
[4]Ex-vessel price per pound of heads-off shrimp.

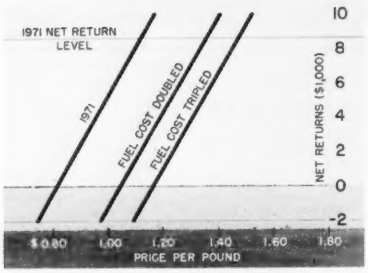

Figure 3.—Net returns and shrimp price relationships for 66- to 72-foot vessels. Costs, other than fuel, crew, and captain shares, were increased by 19 percent over 1971 costs. Price per pound is ex-vessel value for heads-off shrimp.

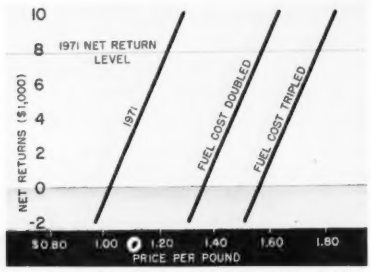

Figure 4.—Net returns and shrimp price relationships for 53- to 65-foot vessels. Costs, other than fuel, crew, and captain shares, were increased by 19 percent over 1971 costs. Price per pound is ex-vessel value for heads-off shrimp.

first doubled and then tripled for this analysis. Table 5 shows the break-even 1971 price based on operating a 53- to 65-foot shrimp vessel. It also shows the actual costs and returns of comparable vessels for 1971. The actual 1971 break-even price was $0.81 per pound. The estimated 1974 break-even price of shrimp is $1.05 per pound. With fuel costs doubled and other costs increased 19 percent, this is an increase of approximately 30 percent from the 1971 level. For the smaller vessels, with the same 19 percent increase in costs and fuel price tripled, the break-even price of shrimp increases to $1.17, or an increase of 44 percent compared to 1971.

Similar information on costs is presented in Table 6 for a 66- to 72-foot vessel. The 1971 break-even price of shrimp was $1.02 per pound. With costs increased 19 percent and fuel price doubled, the break-even price increases to $1.36, or 33 percent above 1971. Tripling of fuel costs increases the break-even price of shrimp to $1.56 per pound, 53 percent above 1971.

Figure 3 shows expected net returns for 66- to 72-foot vessels at alternative shrimp prices using the 1971 costs and with two levels of increased costs. In 1971, as indicated by the horizontal line, the $1.23 price received produced a $7,816 net return. However, that same annual net return with a 19 percent increase in costs and with fuel cost doubled would require shrimp prices of $1.56 per pound, and $1.77 with fuel cost tripled.

Data for the 53- to 65-foot vessel are shown in Figure 4. In 1971 a net return of $8,625 was obtained at a shrimp price of $1.13. To maintain this level of net revenue with a 19 percent cost increase, shrimp prices would have to be $1.36 per pound with fuel cost doubled, and $1.48 with fuel cost tripled.

Figures 5 and 6 contain a present value analysis for small and large vessels, respectively, which determines the break-even annual average price of shrimp that a vessel owner must have for various levels of return on investment. Figure 5 indicates a small vessel owner would have to receive $1.20 per pound to obtain a 20 percent return on investment with an externally financed vessel and fuel prices doubled at the 1971 level. This price increases to $1.30 per pound with fuel prices tripled. For a vessel internally financed, to obtain a 20 percent return on investment, a vessel owner would have to receive $1.35 and $1.50 per pound for double and triple fuel prices, respectively.

Figure 6 indicates that for a large vessel owner to make 20 percent return on investment with external financing, he would have to receive $1.50 and $1.70 per pound for double and triple fuel prices, respectively. For a vessel internally financed to achieve 20 percent return on investment a vessel owner would have to receive $1.70 and $1.90 per pound of shrimp with double and triple fuel prices, respectively.

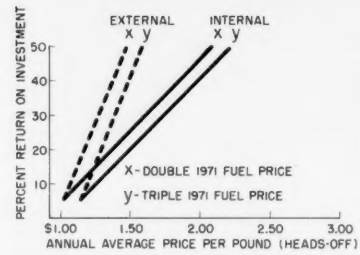

Figure 5.—Break-even price of shrimp for 53- to 65-foot vessels at various levels of return on investment for 80 percent external financing and 100 percent internal financing.

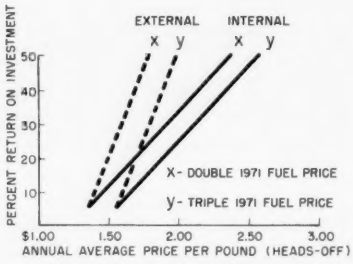

Figure 6.—Break-even price of shrimp for 66- to 72-foot vessels at various levels of return on investment for 80 percent external financing and 100 percent internal financing.

One other important segment of the financial analysis is to determine if vessel owners will be able to make payments when the vessel is externally financed for 80 percent of vessel cost. The break-even price per pound for heads-off shrimp for small vessel owners to just make payments for the first 6 years with costs increased 19 percent above 1971 and fuel costs doubled and tripled is $1.27 and $1.38, respectively. Similarly, for large vessel owners, the price of shrimp would have to be $1.57 and $1.76 per pound with double and triple fuel prices, respectively, to generate sufficient income to meet monthly vessel payments.

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MFR PAPER 1105

An in-depth look at a popular, effective, and economical salmon fishing method.

Puget Sound Drum Seining

WILLIAM L. HIGH

ABSTRACT—Drum seining for salmon in Puget Sound, Washington, began in 1950. By 1970, the drum fleet consisted of 88 vessels. Special drum seining gear includes a net drum about 8 ft. long with 8-ft. diameter flanges, a fairlead to level wind the net onto the drum, and a ring stripper which holds the purse rings at the surface after pursing is complete. Drum seine gear is subject to greater wear and tear than gear used with a power block. Drum seining reduces vessel crew size from six fishermen, required when power block seining, to four men. Drum seines are set at less than full speed to prevent the skiff from capsizing if a net backlash occurs, but net recovery is much faster than when using a power block. Jellyfish tentacles and injuries caused by objects falling from the net are also eliminated. Drum seiners can operate more effectively over shallow, rock strewn bottom. A review of catch records for power block and drum seining during 1966-70 suggests that both vessel and crew of drum seiners achieve higher annual earnings.

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INTRODUCTION

Drum seining (Fig. 1) is an effective and economical means of fishing for Pacific salmon, *Oncorhynchus* spp. Although it is widely used in Washington State and British Columbia and is continually growing in popularity among fishermen, the method, its advantages, disadvantages, and economic aspects have never been described in detail. This report, based on information assembled by personnel of the National Marine Fisheries Service, has been prepared to satisfy that need. Certain portions are necessarily generalized so that the most commonly used approach could be described; other portions refer to specific gear components or procedures observed aboard cooperating vessels.

Figure 1.—Drum seiners are shown at different fishing stages. One vessel has completed its circling maneuver and simultaneously purses and drums the net aboard while the second vessel nears the end of its set. Precise, cooperative timing between the vessel captains will permit the first vessel to complete its net retrieval and move out of the other's net just before it is closed.

Figure 2.—The *Finn* has a fixed-net reel attached to the main deck whereas the reel of the *Patty J.* has been recessed into the deck; the latter also has a pivoting feature. Note that both vessels carry power blocks used earlier in the season when fishing Alaskan waters.

HISTORY OF DRUM SEINING

Seining for salmon in Northwest waters began in the late 1800's. Changes in the gear and methods have occurred, keeping pace with development of modern materials and power sources. The first net reel (Anonymous, 1935) was constructed and installed by Captain Dick Suryan of Hoonah, Alaska, in 1935 for his new seiner *Rio de Oro*. His results with the reel were not recorded and no further reference is made to the fishing method until Nick Kelly of Nanaimo, B.C., reintroduced the drum system shortly before 1950 (Anonymous, 1953a). Drum seining was introduced in Puget Sound by Frank Green of Oak Harbor, Wash., with his vessel *Nonsuch* in 1950.

By the 1953 fishing season, 11 Puget Sound seiners had converted from pulling the seine aboard with the aid of a power roller to the easy handling drum. By midseason of that year, drum seiners were averaging more fish per day than conventional purse seiners (Anonymous, 1953b). Drum vessel crews were composed of five men. Sets were completed in about 40 minutes—considerably faster than nine men pulling the net aboard by the conventional method (Smith, 1954). In 1973, hauling time had been further reduced to about 23 minutes with a four-man crew.

Drum seining attributes became well established and new vessels continued to join the fleet. By 1970, 88 drum seiners fished Puget Sound compared to 179 power block seiners. It should be emphasized that virtually all purse seining for salmon in British Columbia is done by the drum method. Over 370 Canadian drum seiners were licensed in 1972. In spite of early drum seining success, other factors influenced its acceptance in the fishery. Philips (1971) attributes the limited utilization of this major fishing gear breakthrough in Puget Sound to two major factors. First, Alaska enacted legislation to prohibit using the drum seine method. Since many Washington State salmon seiners began the fishing season in Alaska and later moved south, there was less economic incentive for a vessel to maintain two complete fishing systems. Second, the power block went into production in early 1955; 200 were sold within a few months. The power block also reduced work load and crew size, although not to the same degree as the drum system, and power blocks could be readily installed on a wide variety of vessels at much less cost. Most important, it could be legally used in the Alaska fishery.

GEAR COMPONENTS

This section of the paper is devoted to describing those items of equipment used in drum seining that are different from block seining; components common to both systems are not discussed.

Net Drum

As with most fishing gear, the net drum size varies somewhat depending upon the vessel size and personal preferences of the captain. Typically the drum has a 10-inch to 24-inch diameter steel pipe core, 8 ft. in length between the flanges. Each end flange has a diameter of 8 ft. The main engine supplies hydraulic power to rotate and pivot the drum and move the fairlead (level wind).

Figure 3.—The *Patty J.* is equipped with a hydraulically-driven pivoting drum and table to follow the changing angle to the net during retrieval and to reduce the opening between net ends.

Figure 4.—The free-wheeling fairlead posts are hydraulically moved back and forth across the drum face to level wind the net during retrieval.

Drums are either recessed through the deck into a well for improved vessel stability or mounted above the main deck (Fig. 2). The latter method permits simpler conversion to other fisheries, whereas a false deck must cover a recessed drum well.

A few drum seiners have the drum, fairlead, and stern roller incorporated into a hydraulically powered turntable that can rotate up to 180° to follow the changing angle leading to the net (Fig. 3). Fishermen consider the pivoting table to be a convenience rather than essential for fishing success.

Fairlead (Level Wind)

A fairlead is used in conjunction with a roller across the vessel's stern or net table to facilitate even distribution of the net as it winds onto the drum. The level wind consists of two parallel vertical freewheeling posts about 8 inches in diameter, set 18-20 inches apart (Fig. 4). The posts travel back and forth by hydraulic power across the face of the drum. The fairleads can be tipped down or moved to the extreme starboard end of their track to keep them free of the net during a port set.

Ring Stripper or Hairpin

Drum seine fishermen use either a hairpin or a ring stripper to hold rings after pursing is complete (Fig. 5). The hairpin was first reported in *Pacific Fisherman* (Anonymous, 1953a) as a necessary companion development of the drum system.

Net

Considerable extra wear and damage occurs to a drum seine. Corkline floats are severely compressed on the drum, especially those placed on the drum near the core (Fig. 6). Floats which can withstand the tearing and crushing forces are more expensive than those used on most block seines. Often floats are strung on a secondary line which is in turn lashed to the main corkline. In this way, one or two more floats can be strung per fathom, and floats flop back and forth to reduce strain and tearing of the floats as they are wound onto the drum.

Purse lines wear out as much as seven times faster than those used on block seines because of added abrasion when passing purse lines through rings held at the surface. Wear and jamming is reduced by leaving the rings untied to slide the full length of the bridle. However, free mounted purse rings produce greater wear on the ring bridle.

Figure 5.—After pursing is complete, rings are threaded onto a stripping device, then lifted high enough to bring the web clear of the water. Note one fisherman, holding the net out of the water, walks the rings aft to the fixed drum.

Purse Line

Purse lines, of spliceable, braided nylon line, ¾- to 1-inch diameter, are made up in 30 fm sections. The sections have spliced eyes in each end and are joined by lashing or by steel figure eight links. The use of sections permits replacement of worn line without total replacement. It is also possible to purse part of the net while the net is on the drum, by disconnecting a purse line connector and hauling on the free end. Occasionally the purse line doesn't wind onto the drum uniformly with the net. When this occurs, an extra 5- or 10-fathom section of purse line can be added for temporary use.

FISHING OPERATIONS

Drum seining techniques are generally similar to power block fishing except for the operations discussed here.

Crew Assignments

Four men can readily handle the complete fishing operation with minimal physical labor (Anonymous, 1953c). The captain maneuvers the vessel during setting and towing. During pursing and net retrieval, he carries out assorted deck assignments

Figure 6.—Severe strain and compression forces are placed upon floats placed near the drum core. Some relief is provided by stringing floats on a separate corkline which is then laced to the "main" corkline.

including watching for and removing tangled fish or debris from the net.

The cook handles the purse winch and purse line since pursing is normally carried out from one end while simultaneously drumming aboard the net from the other end. After pursing, he monitors the rings and purse line passing onto the drum. Rings must be carried aft to the drum on vessels with fixed reels to prevent an opening in the net (Fig. 5).

Drum controls, including net winding, fairlead positioning, and table pivoting, are manipulated by the engineer. The skiffman's duties are essentially the same as for block seining.

Backlash

Because of the danger of backlashing, drum seiners set more slowly than conventional vessels. A backlash can occur when the drum speed exceeds that of the net during setting or when the net fouls on the drum. When the net is wound on the drum it is under considerable tension which can cause it to bind between earlier wraps or between a wrap and a flange. A foreign object entangled in the net can also cause a hangup. Backlashes are dangerous—particularly for the skiff operator. Should one occur when only a short length of net is in the water, the sudden pull may capsize the skiff. As the amount of net out increases, the danger decreases because the net in the water absorbs backlash shock. *Fishing News International* (Anonymous, 1972) reports that skiff operators reduce the likelihood of capsizing because of backlash by keeping the skiff's bow pointed toward the ship and net (Fig. 7).

A heavy polypropylene web leadline strip in the drum seine reduces snags which might contribute to backlash because objects tend to fall free from the slick material.

Towline

Fishing strategy determines whether the net hauling end will be transferred from the drum to a mast towing cable or be payed out on a long towing warp stored on the drum core. Usually a short rope strap at the end of the net corkline is attached by a quick release link to a cable about 40 feet long affixed part way up the vessel mast. As the net end is payed out, net strain is taken by the mast towing cable. The net end is held in this position just astern of the vessel during the holding-open process and while the net is towed closed. Once the drum begins to retrieve the net, the mast cable is released.

Figure 7.—The skiff keeps one end of the net tied to the bow as the set begins to reduce the likelihood of a backlash turning the skiff over. A nearby skiff tows one end of its net after setting is complete.

Net Configuration

Generally, the drum seine maintains an open kidney shape during retrieval. The skiff can readily hold the vessel out of the net despite a tendency for it to be pulled into the net during active hauling, so when this happens, small bow and stern bends are formed in the net. Net collapse is minimal when drumming and pursing are carried out simultaneously.

Pursing

The purse line arrangement used on drum seines permits hauling procedures to vary depending on fishing conditions. Although a drum seine can be pursed from both ends, it is not commonly done in practice. Normally the net is pursed from the bunt end while the hauling end is drummed directly on board. Most drum seines have the purse line terminated from 30 to 60 fathoms short of the hauling end. Consequently, that amount of net must be drummed aboard before reaching the purse line. However, once the hauling-end purse line is reached while retrieving the net, the purse line can be disconnected to permit pursing both ends simultaneously.

When numerous vessels are fishing in a confined area and net setting room is limited, any part of the drum seine can be quickly set and retrieved, pursing as few or many rings as the captain chooses. Block seines either cannot set or must conflict with other vessels to get their complete net out so both purse line ends can be reached and the net can be lifted to the power block. Occasionally block seines set and retrieve portions of their net by a time-consuming process requiring the boom and power block to be lowered to the deck and the net placed in the block.

Since the ends of the purse line of the power block seine are retrieved over purse blocks on a single davit, the net is drawn together from a single point, thereby minimizing the space between net ends alongside the boat. In a drum seining operation, this potential fish escape route is up to twice as large since one end of the net is drummed from the vessel's stern while the other is pursed at the midship davit. Vessels equipped with a pivoting drum can reduce the open

Figure 8.—Drumming continues at high speed after the table has been turned because it is not necessary to walk rings aft. Ring bridles and web moving across the narrow space between fairlead and stripper tend to inhibit fish from taking the potential escape route under the vessel.

spacing between purse lines by rotating the drum table to the ship's side close to the pursing davit (Fig. 8). Drum seine fishermen do not believe the larger net opening contributes to a significant fish loss.

Handling Purse Rings

Upon completing the pursing operation when the rings reach the surface, they can be immediately placed on the stripping device or held by tension on the purse line.

Aboard the *Patty J.*, a typical Puget Sound drum seiner, drumming was continuous at about 4 ft./sec. after the rings surfaced. Enough strain was maintained on the purse line to hold the rings at the surface even though the purse line was fed through the rings onto the drum (Fig. 9). This practice greatly increased purse line wear but reduced the time and effort required to place all rings on the ring stripper, onto which the last 30 rings were lifted at one time.

In contrast to power block fishing, the drum seine purse line is not removed from the rings when rings are placed on a hairpin or ring stripper. The purse line is returned with the net to the drum after passing through all remaining rings.

Net Repair

Net repairs such as tears, broken ring bridles, etc., are difficult to make on the boat because damaged sections cannot be easily kept accessible on the reel. Regulated short fishing periods each week in Washington State and close proximity to servicing docks permits the crew to periodically transfer their nets to trailer mounted power drums for repair during these enforced fishing breaks.

Any portion of the drum seine can be conveniently set and retrieved, so it is possible to expose an area requiring service in this manner. However, only the short distance from drum to stern roller or fairlead can be worked on at any one time (Fig. 10). Unfortunately the net cannot be put into the water during closed fishing periods for maintenance. Drum seiners which carry a power block quite often transfer the net from the drum through the block to the deck for repairs.

OPERATIONAL ADVANTAGES AND DISADVANTAGES

The primary advantage of drum seining over conventional power block seining is that a crew of only four is necessary instead of six or seven. This is particularly important when experienced crewmen are difficult to hire. Even with the reduced crew, actual labor is less per man.

Operational speed also favors the drum seining technique. Typically a drum seine can be set and retrieved in 23 minutes while the power block seiner requires about 35 minutes.

Figure 9.—Rings are held at the surface while net retrieval continues by maintaining a strain on the purse line. The point at which rings are lifted onto the stripper varies among vessels.

Consequently, the drum seiner can achieve more sets per day.

Certain injuries and delays commonly encountered in block seining are reduced in the drum seining operation. Severe stings from jellyfish tentacles dropping out of the net into the eyes and face, for example, are eliminated, as are injuries from falling fish, sticks, and broken purse rings, since no gear is lifted overhead. Leadline rollups are not uncommon, especially when seiners fish shallow water and the net contacts the sea floor. Drum-seine fishermen can continue fishing with a rollup along nearly any portion of the hauling end. Frequently they will make repeated shallow water sets with a rollup before returning to deep water to clear the leadline.

Drum seiners can more effectively fish over shallow, rock-strewn bottom. Leadlines or purse lines which hang up on rocks or other snags can be freed by temporarily halting pursing and then drumming toward the snag. While drumming, the vessel can be maneuvered over or around the snag.

The advantages of drum-seine fishing must be balanced against certain limitations. Rollups caused by tension placed on the seine during set and retrieval appear to be somewhat more common when drum seining both in shallow water when the leadline contacts bottom and in deep water.

Alaska fishing regulations presently preclude use of drums in that fishery. Therefore, a drum vessel fishing in Washington State which wants to also fish in Alaskan waters must also have a complete power block system.

Port sets are the common method of setting both drum and power block seines. Commonly, fishing strategy dictates that a reverse (starboard) set be made. Reverse sets are less convenient when drum seining because during the first set in the new direction, the leadline tends to cross over the corkline as it comes off the reel.

Some drum seine construction details such as incomplete purse line differ from a power block net so the net is not interchangeable without modification (Fig. 11).

FLEET COMPOSITION

Drum seiners make up a varying percentage of the Puget Sound seine fleet because the number of power block seiners varies. This, in turn, is related to the anticipated abundance of fish each year. Between 1966 and 1970, the power block fleet fluctuated between 104 and 273 vessels. By 1970, the drum fleet consisted of 88 vessels (unpublished report provided by Captain Johnnie Dontos).

Drum seiners tend to fish selected areas of Washington State. These are usually the shallower fishing grounds such as Point Roberts, Boundary Bay, and West Beach.

Available statistics do not completely reflect the economic merits of drum or block seining. The capital outlay for a drum seiner is about $10,000 higher than a comparable block seiner. Also, maintenance for the drum seine is greater. This is offset by the fact that a drum seine can be set easier and faster, which makes it worthwhile to make sets when fish are fewer and more scattered. During periods of "scratch fishing" drum vessels tend to fish on the more valuable species, such as chinook salmon, *O. tshawytscha*.

An economic study of the two fishing methods was prepared by Captain Johnnie Dontos from 1966-70 data gathered by the Washington State Department of Fisheries.[1] Using his data, the following comparisons were drawn from 4-man drum seiners and 6-man power block seiners which were above the fleet average for earnings during the 1966-70 seasons.

	Drum vessels	Power block vessels
Days fished per season	49	36
Daily crew share	$ 73	$ 60
Crew share per season	3,577	2,160
Daily vessel share	292	238
Vessel share per season	14,308	8,568

This cursory examination tends to substantiate the drum seine fisherman's view that his fishing method is more efficient and profitable.

[1]Data on file, Northwest Fisheries Center, National Marine Fisheries Service, 2725 Montlake Blvd. E., Seattle, WA 98112.

Figure 10.—Fishermen aboard the drum seiner *Patty J.* work in the confined space between the drum well and stern to clear a web rollup.

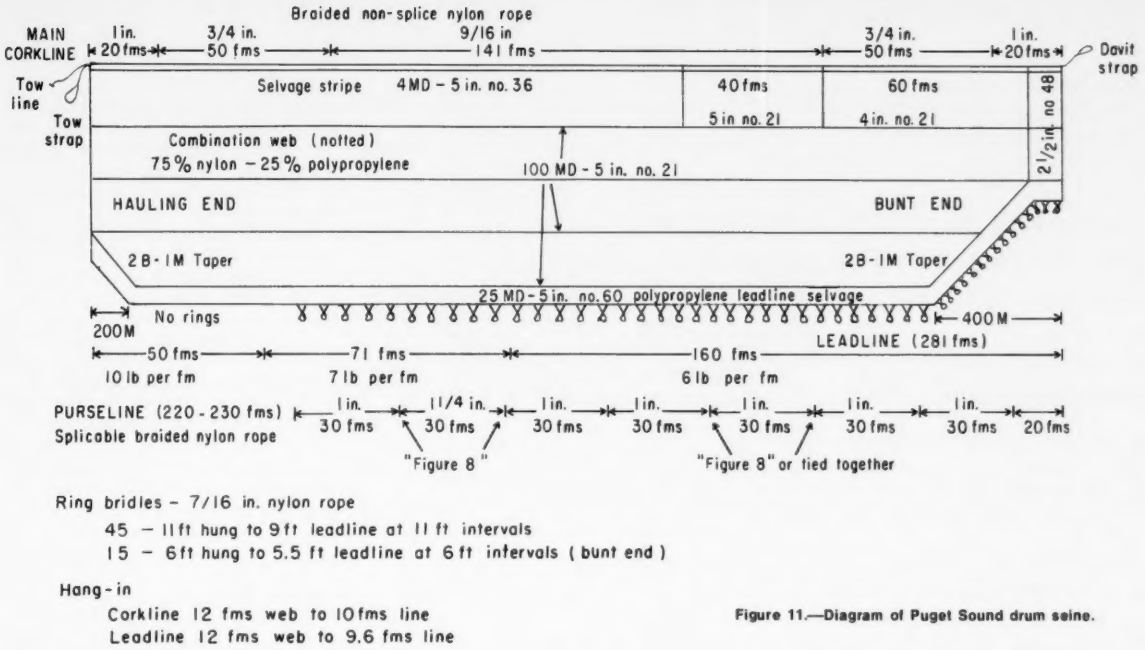
Braided non-splice nylon rope
MAIN CORKLINE
1 in. 20 fms
3/4 in. 50 fms
9/16 in 141 fms
3/4 in. 50 fms
1 in. 20 fms
Davit strap
Tow line
Tow strap
Selvage stripe 4MD – 5 in. no. 36
40 fms 5 in no. 21
60 fms 4 in. no. 21
2 1/2 in. no 48
Combination web (notted)
75% nylon – 25% polypropylene
100 MD - 5 in. no. 21
HAULING END
BUNT END
28 - 1M Taper
28 - 1M Taper
25 MD - 5 in. no. 60 polypropylene leadline selvage
200M
No rings
400 M
LEADLINE (281 fms)
50 fms
71 fms
160 fms
10 lb per fm
7 lb per fm
6 lb per fm
PURSELINE (220 - 230 fms)
Splicable braided nylon rope
1 in. 30 fms
1 1/4 in. 30 fms
1 in. 30 fms
1 in. 30 fms
1 in. 30 fms
1 in. 30 fms
1 in. 30 fms
1 in. 20 fms
"Figure 8"
"Figure 8" or tied together
Ring bridles - 7/16 in. nylon rope
45 – 11 ft hung to 9 ft leadline at 11 ft intervals
15 – 6 ft hung to 5.5 ft leadline at 6 ft intervals (bunt end)
Hang - in
Corkline 12 fms web to 10 fms line
Leadline 12 fms web to 9.6 fms line

Figure 11.—Diagram of Puget Sound drum seine.

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The Japanese are seeking skipjack tuna in waters that reach halfway around the world.

Japanese Skipjack Tuna Fishery Development in Foreign Areas (Katsuo Kaihatsu—Kaigai Katsuo-zuri Gyogyo)

INTRODUCTION

The first of Japan's postwar foreign-based skipjack tuna fisheries was established in northern Borneo in 1960. The fishery, however, was beset with such problems as mass rioting and attacks which endangered the very lives of staff personnel. It was unavoidable that under these conditions the enterprise had to be suspended. In 1962, a fishing operation began in the Gulf of Guinea from a base in Tema, Ghana. Although problems and obstacles were encountered along the way, the fishery has managed to survive over the past 10 years and in general has done very well.

Joint ventures in foreign countries have become of considerable importance during the last several years, beginning in 1969 when a Japanese private firm submitted an application to participate in the Indonesia Fishery Development Project sponsored by FAO in Sorong, West Irian. This was the beginning of this type of activity. Soon, test fishing off Papua New Guinea began from Kavieng in the Bismarck Archipelago. This was followed by operations from bases in Manus, Madang, and Rabaul, and new enterprises began to increase in numbers.

Next, there was a move into waters of the British Solomons where joint ventures have since been established. In Indonesia, test fishing was conducted in waters of Halmahera Island, the eastern and southern Celebes, Sunda Sea, off southwestern Sumatra, and in West Irian waters. Starting in 1972, there was a significant expansion of activities in the Comores Archipelago by vessels based in Madagascar. Meanwhile, numerous enterprises were established to purchase fish in various areas (e.g., Palau, Maldives).

If we stop to consider the reasons for the tremendous development of skipjack tuna fisheries in foreign waters, the following points are evident:

1. In light of the declining tuna longline catch rates, attributable to reduction in resource levels, skipjack tuna have become markedly important as an alternate resource having considerable potential for further development.
2. The mercury-in-canned-tuna problem that arose in the U.S. market in 1970 focused attention on skipjack tuna as the more desirable tuna for canning since this species was found to have relatively low mercury content. The demand for skipjack tuna thus increased substantially.
3. Because of the possibility of harmful aftereffects from synthetic chemical food seasoning, the demand for skipjack as a natural food seasoning has grown.
4. The shortage in Japan of baitfish essential to an expanded skipjack tuna pole-and-line fishery makes it necessary to establish cooperative ventures with foreign coastal countries where baitfish are available.
5. The movement by various countries to establish and to enlarge their territorial seas and fishery zones has threatened Japanese access to areas where baitfish occur, and to skipjack fishing grounds as well.
6. The manpower shortages in our fishing industry can be alleviated by hiring in foreign areas where labor is not only plentiful but inexpensive also (e.g., the contracting of Okinawan fishermen and vessels for certain enterprises prior to the reversion of Okinawa to Japan).
7. FAO is assisting developing countries through fishery development, and considers skipjack tuna a primary potential resource. It is conducting feasibility studies in various areas and is also training local personnel in skipjack tuna fishing methods and techniques.
8. Various coastal countries, many of which are in the "developing" category, are interested in receiving financial and technical assistance from Japan in order to promote their fisheries and thereby enlarge their economic base.
9. The tuna trading companies in Japan and the canners in the United States are in need of a steady, dependable supply of raw material. They have been making direct overtures to industry and government people in the various coastal countries with fishery development plans, and such plans have also been forwarded to interested fishing firms in Japan.
10. In addition to the advances of the American purse seiners into the skipjack tuna fishery, our neighboring countries (Republic of Korea and the Republic of China) have also begun to evince great interest in this fishery.

Thus, concerning Japanese investments in foreign areas, there are at present full-scale commercial operations in Papua New Guinea, where there are three jointly owned local corporations. In addition, joint ventures are being negotiated in British Solomons, Indonesia, Madagascar, and Ghana, each with one company involved. In Indonesian waters, there is trial fishing being conducted from bases in Kendari on Celebes Island, on the southwestern coast of Sumatra, and in the Flores Sea. There is a survey underway in the Maldive Islands and a baitfish survey is also planned for Sri Lanka. In addition, FAO has some work underway in Samoa and Fiji. Thus, there is much activity on skipjack tuna development over a very broad area of the Pacific and Indian Oceans.

Before a fishery can be developed, however, there must be studies con-

This paper, from Katsuo-Maguro Nenkan *(Skipjack-Tuna Yearbook), 1973 edition, is published through the courtesy of its original publishers, Suisan Shinchosa K.K., Tokyo, p. 151-158. Translated from the Japanese by Tamio Otsu, Southwest Fisheries Center, National Marine Fisheries Service, NOAA, Honolulu, HI 96812, July 1974.*

ducted on baitfish availability, skipjack tuna migration and seasonality, skipjack tuna marketing condition, requirements of the local government pertaining to economic promotion (e.g., economics of processing fish locally, training of local fishermen), and myriad other factors taken into account. This is certainly no overnight task.

PAPUA NEW GUINEA

The skipjack tuna live-bait fishing surveys, as well as the joint ventures which have been subsequently established, produced excellent results at the outset. In January 1967 an intergovernmental meeting was held between Australia and Japan to discuss effects of fishing by Japanese tuna longline vessels in the vicinity of Australia. The meeting was called to determine the actual amounts of fish being taken by the longline vessels within the Australian fishery zone (12 miles). A result of this meeting was the signing of the Japan-Australia Fishery Treaty in November 1968.

The Treaty took effect on August 1969, and one of the provisions was for a positive contribution by Japan toward fishery promotion in Papua New Guinea, with steps to be taken for the establishment of joint ventures. The development of the economy of Papua New Guinea was strongly advocated by the Australian Government, and the Japanese agreement to assist in this development was written into the Treaty. In this regard, it was agreed that:

1. The Far Seas Fisheries Research Laboratory and the Shizuoka Prefectural Fisheries Experimental Station would utilize their research vessels to conduct surveys on skipjack distribution, fishing grounds, and tuna baitfish in Papua New Guinea.
2. The Japan Fisheries Association (Dai-Nippon Suisan Kai) would conduct a survey to examine the general economic situation of the area and to critically study the various provisions for establishing joint ventures.
3. The Overseas Technical Cooperation Agency (Kaigai Gijutsu Kyoroku Jigyo Dan) would dispatch a survey team to study plans for the establishment of fish processing facilities in Papua New Guinea, among other missions. In addition, various private companies were also to conduct unofficial surveys.

As a result of the above, the following test fishing and the subsequent development into joint ventures have taken place.

Kavieng (New Ireland)

The provision of the Japan-Australia Fishery Treaty that called for the development of the Papua New Guinea fishery served as the background for the initiation of fishing trials. The results showed that waters of New Ireland, New Britain, and the waters north of the Papua New Guinea mainland abounded with skipjack tuna and that the resource was essentially unutilized. At the request of local authorities, a very intense survey was conducted in these waters. It was learned that with Kavieng, New Ireland, as the base of operations, it would be possible to exploit the skipjack tuna using baitfish readily obtained locally. Following diplomatic negotiations with the government of Papua New Guinea, an understanding was reached. The joint-venture company known as GKFC, trawling for shrimp in waters off the northern coast of Australia, was called in to conduct a 1-year skipjack fishing trial to begin in February 1970. The method of operation was to use the drive-in net (oikomi ami) for catching baitfish employing Okinawan fishermen (who are particularly adept at this technique), and to use three 39-ton Okinawan skipjack tuna vessels under contract. A 999-ton mother ship from Japan was placed on loan to GKFC, and fish taken by these contract vessels were to be purchased and frozen by the mother ship.

The test fishing began a month later, in March. During 1970, there were three vessels under contract, but in 1971, from January to May, four vessels made up the fleet. The catch through May 1971 was approximately 5,000 metric tons. The average catch per vessel per day was an encouraging 4 tons of fish. The fish, frozen in the round on the mother ship, were exported to Japan.

This trial fishing proved the practicality of developing a full-scale commercial enterprise. However, rather than GKFC, a new joint-venture company, GKNG, was formed, with 55 percent capitalization from a Japanese fishing firm. The company, organized in August 1972, had its main office in Port Moresby. Within a year of commencing operations, an "arabushi" (partially dried skipjack tuna stick) factory was completed in Kavieng. Until the construction of a shoreside freezer plant (planned in 2 years), the freezer mother ship was to be utilized in the same manner as during the trial fishing period. The joint venture began with the services of Okinawan fishermen.

However, toward the end of 1971, and continuing into 1972, the catches fell far short of expectations, and both skipjack tuna and baitfish were found to be greatly reduced in availability. It became an urgent matter to determine the cause of this decline and to develop suitable countermeasures. The surface water temperature in the area was found to be 1.5°-2.0°C lower than the previous year. Furthermore, because skipjack tuna are highly migratory, it was imperative that the mode of operation of a fishery based on such fish be critically reexamined.

Manus (Base Later Shifted to Madang)

With the positive results obtained by GKFC in Kavieng, a negotiation was carried out with Australia to commence test fishing out of Manus, Admiralty Islands. The test fishing started in December 1970 with a plan of operation similar to that of the GKFC.

In Manus, however, a 1,300-ton freezer mother ship was utilized. The mother ship carried two small 19-ton bait-catcher boats on deck. In addition, the fishing fleet consisted of 40-ton Okinawan fishing vessels from which the mother ship purchased the fish. Initially the fleet numbered 4 fishing vessels, but by May 1971 there were 5 vessels, and by the end of 1971, 8 vessels. During 1971, about 4,000 tons of fish were taken; the catch averaged about 3.5 tons per vessel per day.

Following this trial fishing period, arrangements were begun for investment in a full-scale commercial operation. However, the Australian Government decided to delay the establishment of a joint-venture company and to extend the trial fishing period by another 6 months. This delay was related to the Papua New Guinea Fishery Promotion Plan, which called for the establishment of an integrated fish processing plant in Madang (Papua New Guinea) is stipulated by the Japan-Australia Fishery Treaty. Trial fishing was resumed, but this time not by a properly registered company, and for this reason all fish caught and processed by the fleet were subject to a duty of 10 percent of appraised value. Consequently, a nominal local company (NMP) was provisionally established. This company had its main office at Port Moresby but its operations office and base were located at Madang. Capitalization of 100 percent was provided by three Japanese companies and the corporation was duly registered in December 1971.

Rabaul

The operation at Rabaul, New Britain, was started at the same time as that out of Manus. Using two 940-ton freezer mother ships, two 19-ton bait-catcher boats, and fishing vessels from Okinawa (5 until June 1971, 8 from July to October, 4 between October and December, and 10 after January 1972), the mother ships purchased the catches made by the fishing vessels. Initially, the catches increased as the fishermen adapted themselves to conditions in the area, and by June 1971, they averaged as high as 7 tons per day per vessel. Between January and December 1971, the average catch was 4 tons per day per vessel. During the 18 months of test fishing, the total catch amounted to approximately 12,000 metric tons. However, beginning in December 1971, the fishing condition worsened markedly just as it did at Kavieng and Madang. Under these conditions, the joint venture was established while hopefully awaiting the return of good fishing. In August 1973, the main office of the joint-venture company, CKPN, was established in Rabaul with 75 percent of the capitalization from the Japanese.

Papua New Guinea Canning Company

The Government of Australia and the Administration of Papua New Guinea, in anticipation of the impending independence of Papua New Guinea and to insure its self-sufficiency, actively promoted the economic development of Papua New Guinea. One of the important programs was the establishment of fish processing plants in the area. Even the administrative guidance exercised over the operations of each private company was predicated on the eventual establishment of such processing plants. Guided by test-fishing results, they set an annual goal of 1,000 tons of fish per vessel for each company and provided for an increased proportion of the landings to be made each year by vessels of Papua New Guinea registry. In other words, in the early stages, most of the catches were to be made by vessels of foreign registry, but gradually the fishing would be taken over by their own vessels. At the same time, there would be a gradual shift from foreign fishermen to local fishermen. Concurrently, the plan was to establish shoreside freezer plants, gradually restricting the use of processing mother ships in the operation while increasing the local processing capability and managing exports of frozen round fish from Papua New Guinea locally. These general conditions were basically agreed upon by the various private companies and the Government of Papua New Guinea, which obviously strongly dominates the agreement.

With this background and with the common need to discharge their obligations under the Treaty, the companies decided that it would be wisest to support the interests of the Government of Papua New Guinea by working towards the establishment of a fish canning company. Thus, the three joint-venture corporations took the lead and with Star-Kist Company and the Investment Corporation of Papua New Guinea, jointly established in August 1972 the Papua New Guinea Canning Company (PNGCC). The establishment of this company was based on results of the Papua New Guinea Fishery Promotion Plan sur-

vey (OTCA) conducted in July and August of the previous year with the technical cooperation of the Japanese Government. The PNGCC was established with equal capitalization by the five companies, and the main office was located in Port Moresby.

SOLOMON ISLANDS

In the past, the economy of the British Solomons has been based on direct assistance from Great Britain. However, since the Solomons is destined for independence in 1975, there has been a move afoot to strengthen the local economic base. Fishery development was advocated, with particular emphasis on the development of a skipjack tuna fishery. As a result of negotiations between Japan and the local government, it was agreed that as a preliminary step towards the establishment of a joint-venture operation, trial fishing surveys would begin in June 1971 with the introduction of five 39-ton Okinawan skipjack tuna fishing vessels. The fleet size gradually increased to a maximum of 15 vessels.

One freezer mother ship of the 500-ton class was situated at each of three bases at Shortland Island, Gizo, and Tulagi. With the aim of providing training and employment to local citizens, Solomon Islanders were employed on the vessels as fishermen, and the skipjack tuna catches were purchased by the mother ships.

During the first 6 months of test fishing, the vessels experienced excellent results. More than 5 tons per vessel per day of 3-4 kg skipjack tuna were taken, for a total catch of 4,300 tons. However, beginning in early 1972, the region was plagued with heavy rains and surface water temperature fell about 1.5°C. Live bait was scarce and skipjack tuna landings decreased by about 50 percent. For about 2 months during this period, some oceanographic surveys, skipjack tuna tagging, and other scientific work were conducted in the area. In November 1972, a contract was signed between the local government and a Japanese fishing company for a joint-venture operation to begin in the spring of 1973. Among the important provisions of the contract was the understanding that the Government of the Solomon Islands would own one-fourth share in the joint venture, gradually assuming control over a period of 10 years in terms of fish production, processing, and export. Fishing vessels were also to change over gradually to those of local registry. In terms of employment of local citizens, establishment of freezer plants and canneries, etc., the contract is quite similar to the one agreed upon in Papua New Guinea.

INDONESIA

Sorong (West Irian)

Before its independence, Indonesia was under Dutch control. The Netherlands Government deposited some funds with the United Nations to assist the developing nation of Indonesia in agricultural and fishery development. The UNDP (United Nations Development Project) decided to utilize a part of the funds to survey the skipjack tuna resources in Indonesian waters and a base was established in Sorong, located in northwestern West Irian. In 1969 Japanese fishing companies were approached to undertake this survey work. Several companies responded with applications and one was selected by UNDP. It commenced survey fishing in October 1969.

This Japanese company operated with 5 of its own 110-ton class skipjack tuna fishing vessels, four 10-ton bait-catcher boats, and a 700-ton freezer mother ship. The baitfish (anchovy) were taken by stick-held dipnet (bo-uke ami) in the vicinity of Sorong, and the skipjack vessels operated within a radius of 250 miles. The skipjack catches were delivered to the mother ship, which remained anchored in Sorong Harbor, and immediately frozen. The operation continued for 18 months, through March 1971.

The survey results are not clear, since FAO was obligated to treat the information in a confidential manner.

Ternate, Kendari

At the conclusion of the FAO-sponsored survey, the Government of Indonesia, a Japanese fishing company, and a Japanese trading company entered into a contract to further survey Indonesian waters as a prelude to establishing a joint-venture skipjack tuna fishing enterprise. Between April 1971 and September 1971, a survey was conducted from a base in Ternate (Halmahera Island). The catches amounted to an average of 3.5 tons per vessel per day. Subsequently, from October 1971 to January 1973, the base was shifted to Kendari on Celebes Island. The survey operations in waters off southeastern Celebes resulted in catches of more than 3 tons per day per vessel. The survey method and scale of operations were similar to that employed by FAO. Following the end of the survey period, preparations were started to establish a joint-venture company. The Japanese companies entered intensive negotiations with the Indonesian Fishery Department on the conditions of the agreement. The matter of the investment of foreign capital was reviewed by the Foreign Investment Commission and received its approval. In October 1972, the venture received final approval from the administration (presidential approval) and it was decided that a joint-venture operation would begin with 80 percent capitalization by the Japanese companies.

Kendari (Southeastern Celebes)

Based on an agreement similar to the preceding, a skipjack tuna fishery development project was started in Kendari with the aim of establishing a commercial skipjack tuna fishery. A preliminary survey was started in August 1971 with a fleet of five 40-ton skipjack tuna fishing vessels and one each of a storage vessel, a transport ship, and a small bait-catcher boat. The base was established in Kendari and the survey was done in waters southeast of Celebes.

Similar to the operations in Papua New Guinea, the fish were purchased from the Okinawan catcher vessels. Because of the unfamiliar conditions in the area, great difficulty was experienced in obtaining baitfish and in locating skipjack tuna schools. A survey period of 1 year was marked by trial and error.

Afterward, the survey was shifted to waters north of West Irian, but the results were poorer than expected and within 6 months it was discontinued.

West Coast of Sumatra

The survey planned for waters off the west coast of Sumatra in the Indian Ocean from December 1971 to July 1972 had to be aborted because of difficulty in obtaining sufficient quantities of baitfish and because of the generally poor weather conditions. Conducted with a single 190-ton skipjack tuna vessel, it was ended after a few months.

Flores Sea, Makassar Strait

A base was established at Kotabaru on Laut Island (south of Kalimantang, Borneo). One vessel of 190 tons did the test fishing for skipjack tuna in Makassar Strait and in the Flores Sea from May 1972 to December 1972, with the aim of determining the feasibility of a joint-venture enterprise. The results, however, were disappointing. Brief test fishing by a single vessel was deemed inadequate unless preceded by a more comprehensive survey that would enable a vessel to select a suitable fishing season, for example.

MADAGASCAR

Skipjack tuna fishing in waters off Madagascar began in early 1972 with a base in Nosy-Bé Island off northwestern Madagascar. Two skipjack tuna vessels of the 190-ton class and one of 210 tons were in the fleet in addition to a 1,200-ton freezer mother ship. The survey operation was planned for 6 months. For bait, anchovy were taken with the stick-held dipnet in the vicinity of Nosy-Bé. The skipjack tuna vessels fished in the vicinity of Comoro Islands (northwest of Madagascar) with average catches of 7 tons per vessel per day. The excellent results quickly prompted negotiations for a joint-venture fishing operation in the area. The survey period was extended to March 1973, when it was expected that commercial joint-venture operations would begin.

In this area, one other company began fishing in late 1972 with a single 192-ton skipjack tuna vessel. This vessel was operated out of a base at Takotabu (phonetic) located on the eastern side of Nosy-Bé. After capturing live bait here, the vessel fished in waters north of Madagascar. Baitfish were reported to be abundant and quite effective for skipjack tuna fishing. Excellent results can probably be anticipated, although the great distance between this base and the baiting and fishing grounds is a distinct disadvantage. This second Nosy-Bé operation is planned for a period of 1 year.

OTHER AREAS

Ghana

Japanese skipjack tuna vessels fishing off Ghana in the Gulf of Guinea are based at Tema. The fishery began in 1962 and continued over the years with gradual improvements in bait capture methods, forced circulation of water in baitwells, brine freezing of catch, etc. There are contracts between the Ghanaian Government and the American company, Star-Kist, as well as between Star-Kist and a Japanese fishing company. In order to catch bait in territorial waters of Ghana, the catches of skipjack tuna must be sold to the Star-Kist Company. Initially, the fleet consisted of five skipjack tuna vessels, but by the end of 1972, there were three 240-ton class vessels, six 284-ton class vessels, and one 300-ton class vessel for a total of 10 vessels. Recently, the annual landings have reached approximately 20,000 tons.

Some problems arose recently between the Government of Ghana and Star-Kist because the latter had failed to provide a promised fish cannery and shoreside processing plants. The problem has largely been ameliorated by the fulfillment of the promises by Star-Kist, and conditions further improved by Japanese capital investment in a joint-venture operation. A contract has been renewed and Japanese vessels once again are assured of baiting and fishing rights in the territorial waters. Arrangements are now under way for the establishment of a joint-venture company, and two vessels with 140-ton carrying capacity for use by this new company are now under construction in San Diego, California.

Philippines

A Japanese-Filipino joint-venture company with 30 percent capitalization by the Japanese company was established in the fall of 1972. This company has as its aim the exploitation of skipjack tuna in the Sulu Seas. The enterprise is based in Jolo Island and in Zamboanga on Mindanao Island. Live bait are caught with former purse seine vessels of about 10 tons imported from Japan, and chartered Japanese vessels do the fishing. The catch is frozen and exported to Japan. Since the latter part of 1972, however, the operation has been in the preparatory stage and a full-scale fishery has not yet started.

Fiji-Samoa

FAO planned a survey of the waters of Fiji in order to develop a skipjack tuna fishery in the area. They issued invitations to various companies interested in undertaking this survey, and finally decided on the charter of a 99-ton skipjack tuna vessel from a Japanese company. In June 1971 the work was begun, but 3 months later the vessel ran aground on a coral reef, halting the survey temporarily. In January 1972, FAO chartered a 39-ton vessel and resumed the survey, planning to run it until March 1973. Up to now, however, the results have not supported the possibility of commercialization, either in terms of bait catches or skipjack tuna fishing. Similarly, FAO is involved in a survey in (Western) Samoa. It is reported that a research vessel has been dispatched to Samoan waters from Hawaii to conduct some research in the area.

Palau

The fish-purchasing operation in Palau was based on skipjack tuna caught by Okinawan vessels. These Okinawan vessels caught skipjack tuna in Palauan waters using live bait taken by the drive-in method (oikomi-ami). The freezership dispatched from Japan purchased the frozen fish and transported it back to Japan. This operation was carried out in 1970 and 1971 by two Japanese companies. Initially, it went well enough, but suddenly the catches dropped off, and both companies terminated operations soon after.

Palau is located in the U.S. Trust Territory and the political power is held by the High Commissioner who comes from the United States. Generally, there are rigid restrictions

governing any economic activities by foreigners in the Trust Territory.

Okinawan vessels operate in Palau according to a contractual arrangement begun in 1965 with the American tuna company, Van Camp. The company purchases skipjack tuna as raw material for canning; in 1971, this amounted to approximately 5,000 tons. Thus, the Japanese operation to purchase fish directly from these boats met with severe competition and this also constituted a serious problem for it.

Maldive Islands

The Maldive Trade Corporation, situated in Colombo, satisfied with the reputation of Japanese fishing companies, approached them regarding the formation of a joint-venture tuna fishery utilizing locally-owned vessels. It was the general feeling that the resource of larger tunas was insufficient for a successful tuna fishery, but there was great interest in the skipjack tuna, which was thought to hold much potential. Several companies responded in favor of entering a joint venture with the Maldive Government.

With the skipjack tuna fishery in mind, negotiations were started between the Japanese and the Maldive Government. The Government indicated that if there were ways of effecting operations that would not harm existing local fisheries unduly, they would be amenable to entering such ventures.

The Federation of Japan Tuna Fisheries Co-operative Associations (Nikkatsuren), with funding from the Ministry of International Trade and Industry (MITI), dispatched a team of six persons to the Maldives to conduct an in-depth survey between 8 and 28 October 1972. The discussion between the survey team and the Government Fishery Department in the Maldives showed that the latter was greatly interested in receiving the cooperation of the Japanese in developing their fisheries. However, there had been some changes in the situation from the time the joint ventures were first proposed, and no definite conclusions were reached. Agreements were made to begin test fishing operations in local waters to examine baitfish and skipjack tuna fishing conditions.

Also, in April 1972, a Japanese company and the Maldive Government reached an agreement in which the Japanese company would purchase skipjack tuna taken by local fishermen. The agreement called for the Japanese to purchase 7-9,000 tons of skipjack tuna per year from the local fishermen. For this purpose, the Japanese company agreed to send a 1,000-ton freezership to the area to purchase the catches on a daily basis. This operation is now under way.

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MFR PAPER 1107

Some Marketing Considerations with Respect to Minced Fish Products

JOSHUA JOHN

INTRODUCTION

There is one thing we can say about the contemporary fish marketing scene without fear of contradiction: it is always changing. And, minced flesh and minced fish products are part of this change. The topic of minced fish conjures up in our minds the wave of the future. From the point of view of the producer, it represents a concept of the maximum and economical utilization of a harvested resource. From the marketing man's point of view, it represents a product of good value at a relatively low price. From the consumers' viewpoint, it represents a "good buy" with perhaps a good deal of what the economist would like to call "consumer's surplus" in it. In short, it is hailed as the untapped bonanza of the fisheries.

This paper first deals with some of the marketing problems surrounding minced fish products; then it outlines some of the exciting opportunities that are ahead; and finally, it touches on some of the ways and means of transforming our great expectations concerning minced fish into a reality.

MARKETING PROBLEMS

What then are the marketing problems with respect to minced fish products (referring to the marketing problems of the producers of minced flesh as well as the marketing problems of converters who use minced fish as a raw material to make end products)? Broadly speaking, we can identify four distinct problems. First, there is the general problem of marketing management that accompanies the introduction of a new product. A new product represents a cycle of change in an otherwise well established and traditional marketing pattern. Each cycle brings with it problems of adjustment. Sometimes, this adjustment process becomes protracted and cumbersome; sometimes it is easy and short-lived. To be beneficial, this cycle of change must be controlled in accordance with market needs.

In introducing a new product, the marketing man has to virtually go back to the drawing board and ask the same old questions he has asked before while introducing other older products. Basically he has to meet five tests. I would like to call them market survival tests. First is the test of profitability. Second is the growth potential test; that is, whether or not there is a need for the product in the market place, and the extent to which there is room for the growth and development of the market to provide as wide a market base as possible for the product. In other words, how big is the present and potential market? Third is, the competitive test; whether or not the product has enough strength and superiority to compete with traditional and even future potential products. Fourth, is the distribution test. The question here is whether or not the new product—in our case, minced fish products—will use existing distribution facilities; or will it require new facilities and channels of distribution. Finally, the investment test tells whether or not the product requires a high or low level of new investment.

Associated with investment is the stability test. That is, those who are planning to invest in this new area must have a reasonable assurance that the rules of the game will not be changed with any degree of frequency. In order to market minced fish products successfully, the marketing man has to meet these basic marketing survival tests.

A second marketing problem with respect to minced fish products stems from the general tendency of the average consumer to perceive price as an indicator of product quality, even in these days of stretching the food dollar. The general consumer feeling is that "you get what you pay for." Such an entrenched attitude can pose a real danger to the marketing of minced fish products. Within the context of high food prices, the sudden introduction of relatively low-priced items, as for example minced fish end products, can create a backlash effect on demand. In order to avoid this danger, a good deal of consumer education and promotion is required to disseminate the real values of the product and to build up sufficient consumer confidence. Not much is known about the consumer likes and dislikes about minced fish products, as yet. This aspect seems to be the 'dark continent' on the marketing scenario at present. I hope that in the immediate months ahead we will be able to explore this area in some detail.

A third marketing problem is the prospect of a sudden and almost overnight entry of too many producers and converters into the production of minced flesh and its products, without adequately preparing a durable and expanding market base. The presence of supernormal or above average profits in a particular product or products can attract too many producers with little or no competence in ensuring product quality and marketing. A sudden overexpansion in production followed by a glut in the market has been the perennial problem of almost all primary industries. Fisheries have been by no means an exception to this general phenomenon. In the fishing industry, we have had far too

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many ups and downs in the past and these have always left devastating effects on the primary, secondary, and marketing sectors. "Those who cannot remember the past are condemned to repeat it." Let us therefore, make every effort to exercise caution and to avoid an over expansion in production without paying corresponding attention to the consumer and the market place.

Finally, in the absence of well defined and strict ground rules with respect to quality, minced flesh is showing up in the market place in a wide range of quality, all the way from good to poor. For a new product trying to gain a footing in the market, this type of inconsistency and variability in quality is a real handicap. And to the converter, who goes in enthusiastically to buy and use minced flesh to create other end-products, this may have and has in fact produced some initial disenchantment. To date, quality control has been one of the main problems for minced fish, and the future marketing prospects for minced fish products will depend to a large extent upon the degree of success attained in eliminating these quality control problems.

MARKETING OPPORTUNITIES

To understand these opportunities, it is essential to take a look at the present and emerging marketing environment for fishery products. Our general marketing environment is characterized by several major factors. First is the growing pressure on existing food resources and an anticipated shortage of animal protein by the year 1980. In mitigating this anticipated protein gap, seafood can play a significant role. Second, within the general context of rising food prices and inflationary trends in the economy, there is a growing pressure and search for cheaper food items. Third, in response to this and also because of the growing cost-price squeeze, producers are increasingly looking for alternate and cheaper raw materials in order to put out reasonably priced consumer products. Fourth, is the growing cross-elasticities within the various components of the food sector and particularly between meat and fish. The consumer is becoming more and more price sensitive and appears to be switching from one protein source to another primarily on the basis of price.

From a purely marketing standpoint, one of the greatest strengths of minced flesh is the substantially lower labor content involved in its production. For example, the production of minced blocks requires only one-third the amount of labor that goes into the regular fillet block. At a time when labor costs are becoming a big factor in production costs, minced blocks offer a very attractive escape route. It provides a fairly cheap raw material for the production of fish sticks, in comparison with the traditional fillet blocks.

Another strength of minced fish products is the virtually unlimited size of the potential future market. The market for convenience foods has been rapidly increasing over the world as a whole. And, what is more exciting is the future possibility of even traditional markets such as Japan turning to convenience foods on a massive scale. As incomes rise, and as the retail and merchandising revolution begins to make an impact on traditional markets, the demand for convenience foods will most likely grow to fantastic proportions. Basic population growth is an additional factor which will reinforce such a growth factor.

A third marketing opportunity for minced fish stems from the high degree of versatility that it seems to possess. That is to say, it lends itself readily to be blended with other ingredients such as vegetable protein, meat, cereals, cheese, potatoes, etc. It permits numerous food combinations to suit the tastes of discriminating consumers. Thus, it lends itself easily to new product development. In the context of today's and tomorrow's food prices, minced fish products represent high value at a relatively low price. This appears to be the fundamental strength of the product. Minced fish products appear to have demonstrated some measure of success in the retail market segments in the United States. Its success in the food service market is now awaited and will be watched with much interest by all.

TAPPING THE MARKET

How do we go about tapping the untapped bonanza? What must we do to seize the opportunities? A philosophical approach to this question could be summed up in the statement that "you cannot strengthen the weak by weakening the strong . . . you cannot help the poor by destroying the rich." In terms of marketing, what this means is that we cannot afford to weaken the market for traditional fish sticks and portions in order to strengthen a completely separate market for minced sticks or portions. Similarly, we cannot afford to destroy the market for traditional sticks and portions in order to build a new market for minced sticks and portions. The salvation of the new product lies in making it a part of the traditional line and thus in marrying the old and the new.

On a more practical level, it is necessary to undertake a good deal of support work in terms of consumer education, market development and promotional literature. We need to bring into force a very comprehensive and energetic consumer education program, while at the same time working on all other elements of marketing, viz. products and product quality, distribution, price, research, and marketing intelligence. Today, more than ever before, the marketing field is experiencing a greater impact of the behavioral sciences. Therefore, it is most essential to make a special effort to inform consumers about the nature and characteristics of the product. We need to know what the consumer's attitude is towards the product: we also need to know what consumer habits affect the product. To this end, we need to put marketing research to work early in the marketing planning exercise. We need consumer panels, consumer tests and consumer education. Actually, we should build the entire marketing program for minced fish products around the consumer.

Perhaps the following quotation from a speech by Mr. Edwin Ebel of General Foods before the 1958 Marketing Conference of the National Industrial Conference Board would give us some perspective with respect

to minced fish products marketing. Mr. Ebel said:

> "So long as men thought the earth was the center of the universe, a true understanding of it was impossible. Only after Copernicus came up with the theory that the sun was the center, and our little earth was just one of several planets that moved about it—only then were astronomers able to make correct observations and reach sound conclusions . . ."
>
> "Now, if we think of our product (in this case the minced fish product) as the center of a small business universe, we are as wrong as the ancient Greeks. Actually, the consumer is the center of the business universe and any product is simply one of a legion of planets that move around the consumer . . . As far as we, as marketers of consumer products are concerned, the thing the consumer is loyal to, is his or her own convictions as to what is best, for his or her own best interests."

In line with this excellent expression of marketing philosophy, I sincerely hope that those who are engaged in or contemplating to engage in the marketing of minced products, will endeavor to follow closely the consumer interests. I would like to add that this whole area provides an excellent and fruitful opportunity for government-industry cooperation. Jointly, the government and industry can identify where we are today, where we want to go, and what we must do to get there. In the long run, the fundamental merits of minced fish products (assuming satisfactory quality control and inspection), from the standpoint of value and price, should make a successful marketing proposition.

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MFR PAPER 1108

Names of Fishes

DANIEL M. COHEN

INTRODUCTION

Commercial and sport fishermen, the food processing industry, consumers, scientists, writers, Federal and State agencies, students and teachers, and many others use names of fishes. Communication about these animals is often impaired because some kinds of fishes have no names, others have more than one name, and some names are used for more than one kind of fish. The obvious solution would be for every species of fish to have one name that was universally recognized as referring to it alone. This article briefly discusses some of the causes of the confusion surrounding fish names.

SCIENTIFIC NAMES

Because they are essentially less complex, let us first consider scientific (Latin) names. The rules for the formation and use of scientific names are governed by the voluntary adherence of zoologists to the International Code of Zoological Nomenclature (International Commission on Zoological Nomenclature, 1964), most recently revised and published in 1964. In essence, the Code tells us that a zoologist who finds a species that lacks a scientific name may describe the species and give it a Latinized name (subject to certain rules and recommendations).

The Latinized name is composed of two parts. Let us take as an example the goldfish, *Carassius auratus*. *Carassius* is the generic name; one or more species may be included in the genus and will have *Carassius* as the first part of its scientific name. The second part, *auratus*, is the specific name and refers to only one species of *Carassius*. Both names together, *Carassius auratus*, make up the scientific name for the species that we recognize as the goldfish. In formal usage, the name of the original describer is sometimes given; hence, a reader might encounter *Carassius auratus* (Linnaeus).

The starting point for scientific names is a book by the Swedish biologist Linneaus, published in 1758. No scientific names published before that date are admitted to the system. If, for any reason, a zoologist gives a scientific name to a species that already has one, the name with the earliest date after 1758 takes precedence. If, for any reason, the same scientific name is given to two species, the last-named one must be given a new name. This system offers a relative stable method of communication. "Poissoa rouge" in French, "chin-yu" in Chinese, "chrusoparon" in Greek, "aranyhal" in Hungarian, "kingyo" in Japanese, "zolotoi ribki" in Russian, and "dorado" in Spanish are all different names for what we call the goldfish. Communication about goldfish is difficult without the universally recognized Latin name, *Carassius auratus*. It is a worldwide code word.

International currency notwithstanding, scientific names cannot replace common names for several reasons. Latin has no meaning for the average person; having two words in a name is cumbersome; and scientific names are subject to change, for as well as being a way of communicating they serve as a working tool of the scientist who classifies animals, and as classifications change scientific names may do likewise.

COMMON NAMES

Common names serve a variety of purposes and arise in many ways. In fact, the only characteristic they share is that they are not Latin. To understand common names properly, we should consider the different kinds.

Folk Names

Local or folk names are the largest class of common names. They are deeply entrenched in the language of a region, and are often obviously descriptive, but sometimes their origins are lost in the past. They may present as much variation within a single language as do goldfish names between languages. An example is *Micropterus salmoides*, widely known as the largemouth black bass. In a study of the common names applied to the fishes of the bass and sunfish family, Smith (1904) listed 53 different common names for this species. A few of them are: big-mouthed trout in Kentucky; chub and welshman in North Carolina and Virginia; cow bass and moss bass in Indiana; grass bass in Minnesota; gray bass in Michigan; green trout in Louisiana; marsh bass, bride perch and pointed tail in Ohio; and perch, trout and jumper throughout the South. Of course, many of these names have died out, but the fact that they once existed and were useful in communicating within a region illustrates what one writer (Macleod, 1956), described as " . . . colloquial names that have grown up spontaneously among ordinary people."

Another characteristic of folk names is the fact that they may reflect a different system of classification than do scientific names or invented common names. Two or more species (as defined by biologists) may not be distinguished and thus receive but a single folk name. One example is the dolphin fish (genus *Coryphaena*), which ichthyologists consider to be two species; laymen recognize but a single species. Conversely, a single biological species may receive several names based on size, life history stage, season, habitat or other characteristic. Consider the biological species *Salmo gairdneri*: individuals from resident freshwater populations are called rainbow trout, while fish belonging to sea run populations are called steelhead.

Invented Names

Another category of common names might be called coined or invented

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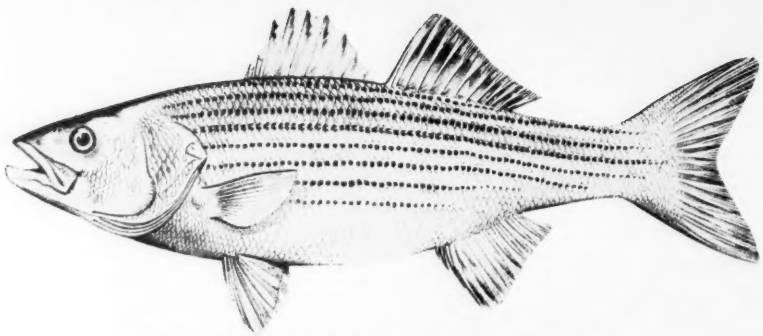


Morone saxatilis—rockfish in Maryland, striped bass in California.

names. Many kinds of fishes are known to scientists alone and have only Latin names. If, in writing of one of these animals a common name is required, one is invented. The American Fisheries Society (Bailey, 1970) has listed all known kinds of fishes living in the United States and Canada to a depth of 200 meters. Some of the fishes on this list previously lacked any common name, and others shared a common name with one or more species. In order to insure a single common name for every species on the list, a number of names were invented. Another reason for inventing names is the importation into the United States of species from non-English-speaking regions. The aquarium trade is the best example: a brief perusal of any authoritative book on aquarium fishes (for example, Sterba, 1962) will show many fishes from South America and Africa for which English language names have been invented. In a popular booklet on Californian deep-sea fishes, Fitch and Lavenberg (1968) invented common names for species that previously lacked them. In some situations, scientists who describe a previously unknown species and give it a Latin name also invent a common name. This practice is common in Japan.

USERS OF COMMON NAMES

One of the chief problems, however, concerns fishes that have more than one common name. Users of names have strong attachments to the familiar. Names of objects are so important to us that we tend to merge the name with the idea of the object. The idea of a piece of leather tied around the foot, and the name of the piece of leather as a shoe, are virtually inseparable. Therefore, in addition to serving as a shorthand way of communicating, names become part of the total concept of an object. Consider, for example, an angler who associates the fish that scientists know as *Micropterus salmoides* with the name green trout. If he is served in thinking about *M. salmoides* or in communicating with others about it by the name green trout, and if the name largemouth bass has no meaning, then to him green trout is that kind of fish, official pronouncements notwithstanding.

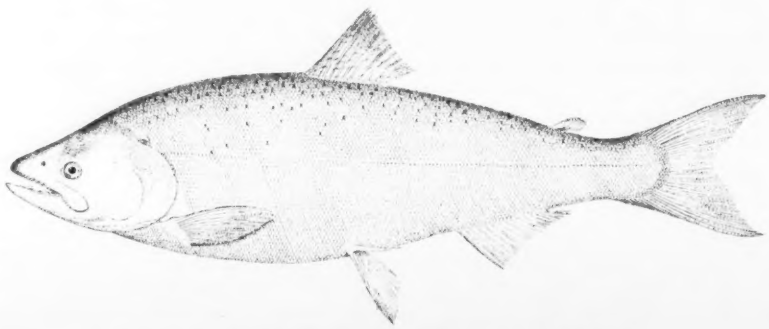
But even so, several fields of interest have a clear need for a single or at least a designated primary name with a high communication value, and the difficult task of evaluating and choosing among available names has been attempted.

In the annual National Marine Fisheries Service publication "Fisheries Statistics of The United States" a glossary is presented which lists scientific and common names, including for many species alternative common names. The names used are those with which the Service is best able to communicate with its varied clientele.

The Food and Drug Administration is concerned with names of food fishes and deals with a set of names that might be termed semilegal. This agency is charged with maintaining standards of identity and its regulations require that labeling must not be false or misleading. In deciding what common names may be used by the food processing and distributing industries, they select (when such exists) a name that is common or usual from the viewpoint of the general public who use and purchase fish products. Allowable names are decided on a case-by-case basis.

Because they often write for a wide audience, outdoor writers are another group requiring common names that do not vary regionally. The Outdoor Writers Association of America (1962) has attempted to promote stability by publishing a list of scientific and common names of principal American sportfishes. Although they hope their common names are widely accepted, they have annotated their list and presented many widely used alternative names.

The scientific community depends chiefly on The American Fisheries Society list of U.S. and Canadian fishes (Bailey, 1970), a comprehensive and authoritative guide to scientific names compiled by a committee of expert ichthyologists. Unfortunately, the general reference value of this list for common names is limited for several reasons. Alternate common names are not listed with each scientific and primary common name, but are, for the most part, relegated to the index. Alternate common name cover-



Oncorhynchus tshawytscha—king salmon in California, chinook in Alaska.

age is restricted. And no documentation is given for common names, not even to the point of indicating which are coined and which are folk names.

DISCUSSION

For legal reasons and other special purposes there is a clear need for certain kinds of fishes to have widely accepted "official" or "primary" common names. Such names may apply strictly to a single biological species, may apply to lesser categories, or may include more than one biological species; only the user's needs can dictate. Scientists have Latin names available and are dependent to a far lesser degree on common names for communication. There is no good reason to invent common names for species treated only by scientists.

There is great need for a general list of fish names, which reports on which common names are used. Such a list should have broad coverage of alternative names. Users should be able to learn whether names are invented or folk names. Sources of invented names should be described and also the degree to which they are used—that is, whether they are found only in books or have entered the spoken language as well. Folk names should be identified as to region, and their degree of usage should also be indicated. The extent to which common names coincide with biological species should be discussed. Such a general list, thoroughly documented and cross-indexed, would serve as an invaluable source of data for those who require information on, and must make decisions about, common names of fishes.

SUMMARY

Names of fishes are basically of two kinds, invented and folk names. Scientific names are invented and are usually, but not always, stable; however, they are not suitable for everyday use. Some common names are also invented and may be important, as for fishes imported from foreign language regions. Folk names may vary regionally. They originate in many ways and their usage is often deeply rooted. Various segments of the common name-using public often use different names for the same species or the same name for different species. A common name may not coincide exactly with the Latin name of a biological species. Because many common names have a high communication value and have also become part of the idea of the animal, it will probably be impossible for each species to have one common name that refers to that species alone. Users of common names for special purposes have attempted to list the names that serve them best. A well-documented general list, including alternative names, is needed.

ACKNOWLEDGMENTS

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MFR PAPER 1109

Hope is seen for a seasonal, directed New England squid fishery.

The Potential for an Offshore Squid Fishery in New England

F. E. LUX, W. D. HANDWORK, and W. F. RATHJEN

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INTRODUCTION

The long-finned squid, *Loligo pealei*, is the common squid off southern New England, and it makes up about 90 percent or more of the total squid catch there (Summers, 1967).[1] From late spring to early fall this species is distributed over the entire continental shelf from the coastline to the shelf edge, although the greatest concentrations are on inshore grounds where spawning occurs (Rathjen, 1973; Grosslein and Bowman, 1973; Serchuk and Rathjen, 1974). In the late fall it moves to the warmer waters of the outer shelf edge and there remains until spring.

[1]The remainder of the squid catch is the short-finned squid, *Illex illecebrosus*, which is more common on Georges Bank and to the northward off Canada.

Squid have been of relatively small importance to U. S. otter trawlers, due largely to the limited domestic market demand. They landed only 1,152 metric tons (2.5 million lb) in 1973, a figure which has not varied greatly during the past 10 years. The otter trawl is, however, the principal gear used to harvest squid. The U.S. catch is taken primarily during the summer and is incidental to trawl effort for fin fishes; there is essentially no directed fishery for squid.

Catch statistics published by the International Commission for the Northwest Atlantic Fisheries (ICNAF) show, on the other hand, that a number of foreign nations are actively catching large amounts of squid in this same area at present, and that their catch is increasing. The total taken by all countries in 1972 in ICNAF Subareas 5 and 6 was 48,565 tons (107 million lb) (Table 1, Fig. 1). This is more than double the 1971 catch (Fig. 2). Preliminary catch reports indicate that the total for 1973 was about 56,000 tons (123 million lb). Much of this catch by foreign vessels is made from late fall to spring when the squid are concentrated offshore. The Japanese, for example, fish these offshore areas from November to May (Ikeda and Nagasaki, 1973).

The total allowable catch of squid in Subareas 5 and 6 in 1974 was set by ICNAF, on the basis of stock assessment, at 71,000 tons (157 million lb). Of this, the quota allotted for the United States was 5,600 tons (12.3 million lb).

CHARTER OPERATIONS

Since the active and directed fishing for squid by foreign fleets indicates a large world demand and also the possibility of expanded domestic markets,

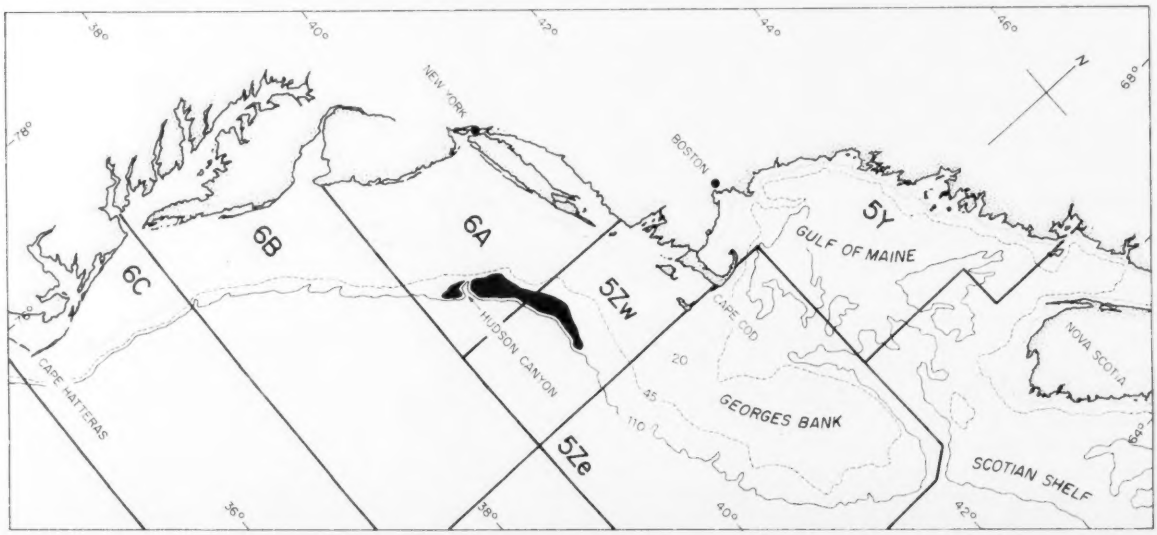

Figure 1.—Fishing areas off northeastern United States and the ICNAF statistical divisions of Subareas 5 and 6 used for reporting catch. The shaded areas northeast and southwest of Hudson Canyon were the areas fished for squid in the exploratory trips in January-February 1974. Depths are given in fathoms.

Table 1.—Reported catch of squid from Georges Bank to Cape Hatteras (ICNAF Subareas 5 and 6)[1] in 1972, by country.

Country	Catch by ICNAF Subarea					
	5Ze	5Zw	6A	6B	6C	Total
	Metric tons					
Italy	—	—	1,018	1,478	704	3,200
Japan	6,693	1,169	4,079	5,835	915	18,691
Poland	4,941	101	313	69	4	5,428
Spain	3,912	1,885	638	2,248	3,177	11,860
USA	7	407	286	306	146	1,152
USSR	5,469	832	410	169	16	6,896
Others[2]	441	129	432	324	12	1,338
Total	21,463	4,523	7,176	10,429	4,974	48,565

[1] The reported squid catch in Subarea 5Y (Gulf of Maine) was only 125 tons (0.3 million lb) in 1972. Catch per tow in trawl surveys also is low there (Grosslein and Bowman, 1973).
[2] Includes Bulgaria, Cuba, France, Romania, and West Germany.

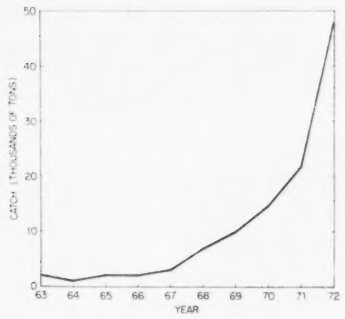

Figure 2.—Reported catch of squid by all countries in ICNAF Subareas 5 and 6 in 1963-72, in metric tons. Source: ICNAF Statistical Bulletin, Vol. 22 (for the year 1972).

the National Marine Fisheries Service[2] in 1973 began looking into means of generating incentive for a larger U.S. squid fishery. Because most of the foreign catch is with otter trawls on offshore concentrations in fall and winter, the Service chartered a trawler for four trips, about 1 week each, in January-February 1974 to test the feasibility of directed squid fishing at that time. This report summarizes the results of those trips.

A commercial stern trawler, the *Valkyrie*, of New Bedford, Mass., 30 m (99 feet) long and 700 hp, was chartered for the work (Fig. 3). Two styles of otter trawls were used. One of these was a No. 41 Yankee trawl modified to a 4-seam, high-opening net and hung on a 21.6 m (71-foot) headrope and 29 m (94.5-foot) footrope. The mesh size, stretched measure, was 114 mm (4.5 inches) in the codend and 127 mm (5 inches) forward of the codend. The other net was a 2-seam Yankee-style trawl, also modified for high opening, with a 21.3 m (70-foot) headrope and 27.4 m (90-foot) footrope. It had a 51 mm (2-inch) mesh body and a 127 mm (5-inch) mesh codend. Codend liners, 13 to 51 mm mesh, were used in both trawls. No time was available for an accurate comparison of these trawls during the charter trips, and about all that may presently be said is that they caught squid in relatively good, and about equal, amounts. Average catch per unit of effort for both trawls combined is given later in this report.

Tows were of 2 hours duration at a towing speed of 3.5 knots. Operations were carried out around the clock.

[2]The work was carried out under the New England Fisheries Development Program, a Government-Fishing Industry cooperative effort.

The area over which fishing was tried, along the shelf edge on both sides of Hudson Canyon, is shown in Figure 1. Water depth there ranged from 91-165 m (50-90 fm), with most tows being made in 119-146 m (65-80 fm). The bottom temperature ranged from 56-60°F and averaged about 57-58°F for all trips combined. Since the winter of 1973-74 was a mild one, this is higher than the 46-52°F usually found there in the winter (Walford and Wicklund, 1968; Colton and Stoddard, 1973).

CATCH VALUE

Squid with mantle lengths of less than 14 cm (5.5 inches) were considered small market size; those 14 cm and over were large. The size separation was done on board and the squid were iced whole. An estimated 1 percent or less of the squid catch was short-finned squid. Some of the incidental catch of finfish, including summer flounder, butterfish, and tilefish, also was saved and marketed.

The landed catches for each of the 4 trips (Table 2) show that about 80 percent was squid. The ex-vessel prices received per pound were 10 cents for small squid and 20 cents for large. The average price for all

Figure 3.—The stern trawler, *Valkyrie*, 99 feet long and 700 hp, used for the squid charter trips.

Table 2.—Landed catch and ex-vessel value for squid charter trips in January-February 1974.

Trip number	Dates	Number of tows	Landed catch		Catch value
			Squid	Finfish[1]	
			Pounds		*Dollars*
1	8-13 Jan 1974	52	37,500	1,975	6,670
2	18-24 Jan 1974	60	50,200	6,760	8,508
3	29 Jan-4 Feb 1974	55	41,750	3,640	7,416
4	10-15 Feb 1974	51	39,625	3,950	7,206
	Total	218	169,075	16,325	29,800

[1] The landed finfish consisted of butterfish (39 percent), summer flounder (28 percent), tilefish (28 percent), goosefish (4 percent), and scup (1 percent).

squid landed was 15.5 cents. The incidental fish catch was about 12 percent of the gross trip value and averaged 22 cents per pound, ex-vessel.

The price for squid was much less than the 40 cents per pound or more sometimes received for the small quantities of large squid landed in the summer and sold fresh in domestic markets. The principal reason for the low prices appeared to be that the market was not geared to absorb the large catches at the time of the charter trips. This is related to the considerable market resistance on the part of the U.S. consumer, who is slow to try nontraditional seafoods. Incidentally, quality tests of the squid from the charter trips indicated that they kept well in ice (Fig. 4).

The best area for fishing in all four trips was found to be on the southwestern edge of Hudson Canyon in about 119-146 m (65-80 fm) (Fig. 1). Catches here varied from about 32-1,900 kg (70-4,200 lb) per tow. To the northeast of Hudson Canyon, catches ranged from 16-725 kg (35-1,600 lb) per tow. For all trips combined, the average catch per hour of towing time was 234 kg (517 lb) southwest of Hudson Canyon, where about 65 percent of the fishing was done, and 88 kg (193 lb) northeast of there. In view of the large catch by foreign vessels on the outer shelf, it is likely that there were other concentrations of squid such as that found southwest of Hudson Canyon. Limited time, however, ruled out extensive scouting.

DAY-NIGHT DIFFERENCES

As is well known, squid are most likely to be near the bottom, and catchable with bottom trawls, during daylight. For the experimental trips we have therefore summarized catch per hour by six-hour time periods: 2400-0600 hours, 0600-1200, 1200-1800, and 1800-2400 (Fig. 5). The period 0600-1800 hours covered the daylight period. As the graphs show, catches were consistently better during daylight, with the best catches, about 340 kg (750 lb) per hour, being obtained in the afternoon (1200-1800 hours). For all trips and all areas combined, about 65 percent of the squid catch was made during daylight.

Random samples of the squid catches were measured from most daylight tows and from some night tows to define the size composition. The sizes ranged from 4 to 32 cm mantle length (Fig. 6). Since the squid trips were experimental in nature, several mesh sizes were tried in the codend liner. During trip 1 a 13 mm (½-inch) mesh liner (stretched mea-

Figure 4.—NMFS food technologist examines the landed squid catch of the *Valkyrie*. Tests at the NMFS Northeast Utilization Research Center, Gloucester, Massachusetts showed that the shelf life of heavily iced squid was at least nine days.

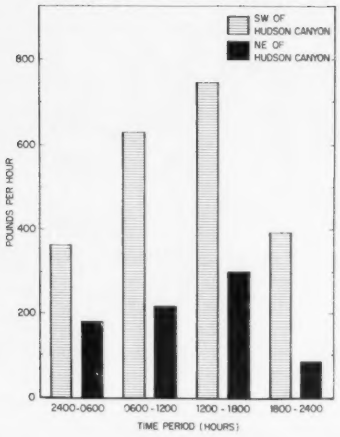

Figure 5.—Squid catch per hour's fishing in relation to time of day (eastern standard time).

sure) was used in the codend, and this presumably retained all sizes of squid entering the trawl. The size distribution for this trip indicates that there are modes at about 7-8 cm and 11-13 cm mantle length. These possibly represent two age groups, but growth data presently available are insufficient to clearly define age (Summers, 1971). Mesh sizes for trip 2 were 13, 32, and 51 mm (½, 1¼, and 2 inches), each used roughly equal time; for trip 3, mesh sizes were 32 and 51 mm, also used about equal time; and for trip 4 mesh size was exclusively 51 mm. The size frequencies show that there was some escapement of small squid, and therefore a higher average size retained by the net, when a 51 mm liner was used (Fig. 6). The data, however, are inadequate for defining a mesh selection curve. They demonstrate, nevertheless, that some of the small, immature squid, for which there is limited market demand, can be eliminated from the catch through the use of larger mesh gear, probably larger than 51 mm. Using a larger mesh also would reduce the amount of small, unmarketable fish caught, such as little butterfish, and would cut shipboard sorting time.

ECONOMIC FEASIBILITY

The ex-vessel value of the squid and incidental fish catch in the four charter trips amounted to $29,800, or about $1,250 per 24-hour fishing day. Vessels similar to the *Valkyrie* were grossing about $1,500-$3,000 per day on groundfish (cod, haddock, and associated species) at this same time. Fishing for these traditional species therefore was clearly more attractive to fishermen than fishing for squid. With a slightly increased catch rate for squid and a better price, however, a directed fishery for squid offshore could become a reality, at least on a seasonal basis.

In assisting in the development of such a directed fishery it would be useful to: 1. consider the possibility of freezing catches at sea, as is done on foreign vessels to insure highest quality and price; 2. improve trawl gear for squid; and 3. investigate the sonic detection of squid.

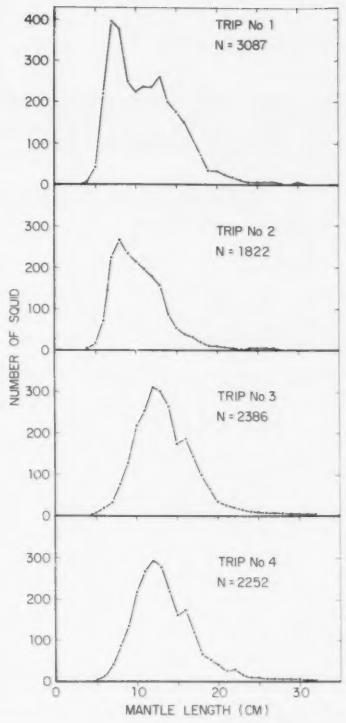

Figure 6.—Size frequencies of squid, *Loligo pealei*, measured during the January-February 1974 charter trips. (N is the number measured. See text for the codend mesh size for each trip).

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MFR PAPER 1110

Strides are being made toward tapping a large oceanic protein source.

Squid—Its Potential and Status as a U.S. Food Resource

VINCENT G. AMPOLA

INTRODUCTION

There are about 350 species of squid that inhabit the oceans and seas of the world. They belong to the division of molluscs known as cephalopods, the "head-footed" animals, close relatives of the cuttlefishes and octopi, and more distantly related to clams, oysters, and scallops. In fact, the fringe of appendages surrounding the head area of all cephalopods is a modification of the fleshy foot of their primitive molluscan ancestors, and the single, slender chitinous "pen" that lines the internal dorsum of the body is all that remains of the shell. The distinctive morphological features of a typical squid are shown in longitudinal section in Figure 1.

All squids propel themselves by taking in and forcibly expelling water from the mantle cavity through the siphon. The force and direction of the water expelled plus the undulation of fins and body determines the direction and speed of the animal. They move opposite to the direction of the water ejected from the siphon and so can move forward or backward with great rapidity. The circulation of water through the mantle also provides oxygen for the gills which hang free within the forward part of the mantle cavity.

All cephalopods are carnivorous, and when young, subsist on small invertebrates such as copepods, euphausiids, and gastropods. Older squids live on fish such as capelin, cod, crustaceans, and other molluscs. Squids usually have ten appendages arranged in five pairs around the head. Eight are short and heavy and are called arms; the fourth pair down, as one counts from the dorsum, are called tentacles and are about twice as long as the arms.

The ink sac is a reservoir containing a brown or black viscous fluid which is ejected through the siphon when the squid is alarmed. This "ink" not only forms an effective screen behind which it can escape, but it is believed that the alkaloids present in it paralyze the olfactory sense of the enemy, thus aiding the squid in its escape.

The unusual coloration of cephalopods is caused by the presence of pigment cells or chromatophores in the integument that contain red, blue, yellow, and black pigments in concentrations specific to each species. The chromatophores are controlled by muscles which are actuated to expand or contract by visual or olfactory stimuli, thus changing the colors of the animal. It has been observed by the author and fishermen that after death, it is the release of these pigments into the flesh of the animal that is an indicator of the onset of spoilage.

WORLD POTENTIAL OF THE RESOURCE

For centuries, squids have been used as an important and palatable source of food in the countries bordering the Mediterranean Sea and in the Orient. They are found in all the seas and oceans of the world, and are so numerous that they can be considered one of the greatest untapped sources of protein to be found in the marine environment. Their fecundity and exceptionally high growth rate combine to help ensure a substantial fishery.

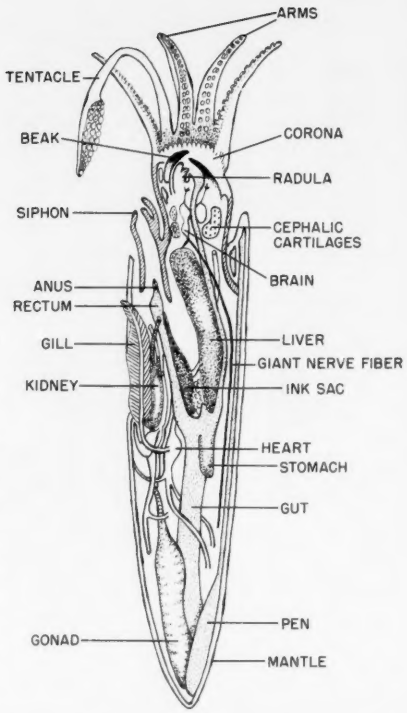

Figure 1.—A squid in longitudinal section, excluding tailfins.

According to Voss, who is cited in an article in *Fishing News International* (Anonymous, 1973), those parts of the seas from the middle of the continental slopes to the shoreline where cephalopods are presently being fished constitute less than 10 percent of the total ocean surface. Present catches are derived mostly from inshore species and those oceanic squids that migrate to inshore waters during part of their life cycle. The squid resource is therefore underexploited in about 90 percent of the world's ocean area. In the same article, other experts estimate that the annual potential production of oceanic squids probably lies within the range of 90 to 280 mil-

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lion metric tons. From 1968 to 1971, the reported world catch of all species averaged 600,000 metric tons.

Additional and pertinent information on the world biomass and distribution of oceanic squids, and the present gear and the numerous methods used in harvesting them, is given by Filippova (1970, and 1971), Anonymous (1973a), Voss (1973), and Zuev and Nesis (1971).

THE UNITED STATES SQUID FISHERY

From 1968 to 1971, the reported yearly United States harvest averaged 13,300 metric tons (Anonymous, 1969, 1970, 1971, and 1972). About 90 percent of this catch consisted of *Loligo opalescens* caught in southern Californian coastal waters. The fishery is conducted year-round, with maximum hauls taken from May to July. Most of this catch is canned or frozen, but lately much of it is being sold fresh, as it is rapidly becoming a popular entrée in west coast restaurants.

Another species of squid harvested in the United States is the long-finned or "bone" squid (so called because of its broad pen and a tail half the length of its body), *Loligo pealei*, which inhabits the western Atlantic from Venezuela to Nova Scotia but is most commonly found from Cape Hatteras to Cape Cod. They inhabit the inshore waters of the continental shelf of the middle and south Atlantic States in the summer and autumn and the outer part of the continental shelf in the winter and spring. The bulk of the reported catch is brought in as incidental catch to the trawl fishery, and a smaller amount is taken closer to shore by traps. Data from the ICNAF Redbook (Anonymous, 1973b) indicate that from Cape Cod southward to the Baltimore and Wilmington canyon areas, a yearly maximum sustainable yield of 71,000 metric tons of *Loligo pealei* is possible. Until 1973, about 75 percent of the catch was sold to the fresh market, but lately more of the catch is being frozen and exported to European countries, as demand there has risen considerably.

The other commercially important species caught off the eastern coast of the United States is the short-finned (the tail fin is about one-third of the body length), "summer," or "Newfoundland" squid, *Illex illecebrosus*. It occurs southward to the Gulf of Mexico but is most commonly found in the summer and fall from Cape Cod northward to the Maritime Provinces. Its greatest use in the past century or so has been as cod bait both in Canada and the fisheries of Portugal and the Scandinavian countries. In this country, this species is taken incidentally to trawling operations, and very little is sold to the fresh market.

The distribution, biomass density, some biological data, and the methods and gear used in capturing these Atlantic species are reported by Nesis (1968), Noskov and Rikhter (1971), Rathjen (1973), Serchuk and Rathjen (1974), Squires (1957), Vovk (1969), and Vovk and Nigmatullin (1972).

NUTRITIONAL ASPECTS

Compared to other marine animals eaten by man, squid have a larger proportion of edible parts to the whole body. With vertebrate fishes, the recoverable edible portion ranges from 20 to 50 percent; and in the commonly eaten shellfish, the edible parts are from 20 to 40 percent. In squids, the edible portion—which consists of the mantle, tail, arms, and tentacles—is from 60 to 80 percent of the weight of the animal, depending on the species and its size.

Squid meat is equal to fish meat in protein content (16-20 percent) and amino acid composition and can be considered as an excellent source of protein (Takahashi, 1965). Its food energy equivalent is about 85 calories per 100 grams of raw meat.

The fat content of squid flesh has been reported as varying from 1 to 5 percent (Kitabayashi, Nakamura, Shudo, and Ishikawa, 1963). This fat contains a considerable amount of cholesterol; but since the quantity of fat is low, the amount of cholesterol present does not constitute a health hazard even to those who are on restricted diets (Korobkina, Danilov, Kalinina, Tsurkova, and Andreeva, 1968).

A definite advantage of squid meat over fish is that in some cases, no matter how well the fish are filleted, the meat could still contain some bones; but for squid, once the beak and "pen" are removed in the cleaning process, there are no remaining bones to concern the processor and, ultimately, the consumer. In addition, there are no data in the literature at the present time that indicate that squid flesh harbors any parasites that are harmful to man.

MANUAL PROCESSING

In order to hand-clean squid for further processing, it is necessary to wash each one under running water in order to remove any adhering foreign matter or ink which will stain the meat. The squid is then laid flat, and the arms and tentacles are severed from the body by cutting through the head just in front of the eyes. The beak, which is located in a pouch in the base of the corona of appendages (Fig. 1), is removed by simply squeezing the pouch out from its attachment with thumb and forefinger.

To clean the body, insert a knife blade into the mantle cavity and slit the mantle down to the base of the tail. Pull out the visceral mass, including the "pen," and discard. Lay the mantle flat, and with the knife edge scrape away any visceral remnants and ink as well as the pair of gills adhering to the inside of the mantle wall. Some processors simply squeeze out or manually pull out the visceral mass and "pen" in order to leave the body intact. Wash the cleaned parts under running water. Removal of the skin from the mantle, arms, and tentacles is optional and laborious and can be accomplished in some species by hand-peeling or by scraping. Sometimes, blanching the meat in hot water (75°-85°C) for a few seconds will facilitate this process. Japanese researchers and others have been studying the use of proteolytic enzymes in conjunction with agitation as a means of removing the skin (Okuda and Kon, 1965).

MECHANICAL PROCESSING

In order to make a squid fishery economically feasible, fast, efficient mechanical means of heading, eviscerating, skinning, and cutting the flesh into appropriate size pieces must be developed.

Recently, mechanical skinning of

flat-cleaned squid mantles, as well as eviscerated, intact mantles, was achieved by passing them skinside down through a modified Jensen Type B fish fillet skinner (manufactured under license by Kitchen of the Sea, Inc., Malden, Mass.[1]). In this procedure, round-cleaned squid, and also uneviscerated, headed squid were skinned on one side only. For complete skinning, the body is turned and run through the skinner again so that each side is, in turn, exposed to the cutting knives. It is possible that other models of fish fillet skinners now in use can be modified to skin squid in this manner. It is also possible that machinery of this type can be modified to eviscerate as well as skin squid.

[1]Reference to trade names does not imply endorsement of commercial products by the National Marine Fisheries Service, NOAA.

High-speed mechanical cutting of squid flesh into slices has successfully been accomplished by passing the flesh through an Urschel Model J dicer (manufactured by Urschel Laboratories in Valparaiso, Ind.) Figures 2 and 3 show the cutting end of the apparatus and the shape of the pieces produced in one pass. The cleaned mantles and arms are fed onto a high-speed conveyor belt which carries them to serrated circular cutting knives which are adjusted by the use of spacers so that a selected width of cut can be achieved. The strip thus formed is then crosscut into squares or strips. The efficiency of the dicer, as measured by the number of acceptable cuts per unit of weight, is about 75 percent when flat mantles were passed through at ambient temperature. When the mantles were stiffened by being partially frozen, the efficiency was increased by an additional 12 percent. Pieces that emerged uncut, due to doubling over of the mantle, can be run through the machine again, and tailings or pieces that are too small to be acceptable can be separated from acceptable cuts by being forced through the apertures of an appropriate size sieve by a strong jet of water. If squid rings are desired, the knives are set to a narrow width cut, the crosscut blades are removed, and the intact, whole eviscerated mantles, without tail fins, are passed crosswise into the cutting knives.

For further processing, breading and packaging machinery as well as precooking, canning, bottling and sterilizing units are now available as on-line production equipment.

The solution, then, to achieving processing automation is the development of an apparatus that will behead the squid and remove the mouth sac, and one that will completely eviscerate the squid and remove the pen. With the advent of this type of machinery, a completely automated production line to process squid from dockside to finished product would be possible.

Figure 2.—Model J Urschel Dicer showing stripping and crosscut knives.

ICED SHELF LIFE

Several experiments were performed in order to determine the length of on-ice shelf life of the two local commercial species. In the first series of experiments, freshly caught, iced, and refrigerated squid were brought to the Northeast Utilization Research Center within 18 to 24 hours after capture. The ice was removed and they were packed in wooden boxes together with flake ice in a ratio of one part of squid to one part of ice (by weight), two parts of squid to one part of ice, and five parts of squid to one part of ice. This was accomplished by placing the appropriate amount of ice on top of the squid and simulated poor icing technique. The boxes were then stored in a refrigerated room ($3°C \pm 1°$), and the top ice lost due to melting was replenished as needed. Sensory testing was done on each lot daily in order to determine the shelf life of the squid.

In the last three experiments, squid trawled by the vessel *Valkyrie* (char-

Figure 3.—Machine cut squid mantle (*Illex illecebrosus*).

tered by the National Marine Fisheries Service to test the feasibility of directed squid fishing), and heavily iced in crushed block ice immediately after capture, were kept that way during extended refrigerated storage to test optimal conditions. The results shown in Table 1 indicate that, in all probability, the time of year the squid were harvested, as well as the amount of ice used during storage, has a definite beneficial effect on the shelf life of squid.

Table 1.—Iced shelf life of round squid held in ice at an ambient temperature of 3°C ± 1°.

Squid to Ice Ratio	Month Caught	Shelf Life (days)
Illex spp.		
1:1	July	5
2:1		5
5:1		4
1:1	September	8
2:1		8
5:1		7
Loligo spp.		
1:1	May	6
2:1		6
5:1		3
1:1	January	9
1:1	January	9
1:1	February	10

PRODUCT DEVELOPMENT

At present, the only commercially prepared squid products produced in the United States are squid canned with or without its ink in brine, in oil, and in tomato sauce. The 1970 canned pack was about 1 million pounds and was probably destined for strictly ethnic markets. Among the present functions of the Northeast Utilization Research Center are product development and preservation, and the promotion of underutilized marine species, both to help the fishing industry and to introduce new and palatable foods from the sea to the American public. Squid is a prime example of an underutilized species.

Many squid recipes were formulated and tested for acceptability by taste panels with excellent results. These include squid in chowder, in thermidor, and in various tomato sauces. Squid meat was used as an ingredient in stuffing, alone, and in combination with clam meats and textured vegetable protein. With the addition of binders such as starches, albumen, or homogenized fish flesh (Learson, Tinker, and Ronsivalli, 1971), portion-controlled, breaded, precooked patties were developed. The development of rancidity in raw or processed squid products was never a problem, even when they were held in frozen storage for a period of several months.

Two products that show definite promise as consumer items are frozen breaded squid, and marinated squid. Breaded squid are prepared by cleaning and machine cutting the mantles and tails into bite-sized pieces, which are then battered, breaded, packaged, and frozen. They can be deep-fat fried directly from the frozen state for consumption. Studies by marketing personnel of the National Marine Fisheries Service and by personnel at the Northeast Utilization Research Center indicate excellent acceptance of the product even after months of frozen storage.

Preliminary packs of marinated squid were made by mixing diced, precooked squid, including arms, with vinegar, olive oil, and spices. They were packaged in glass jars and kept under refrigeration below 3°C. The quality of the product was highly acceptable for a 12 month storage period. Total bacterial plate counts on Eugon agar incubated at 37°C ranged from a high of 1,400 organisms per gram to zero at the end of the storage period.

COOKING CHARACTERISTICS

Fresh squid can be cooked in either of two ways. They can be quick-cooked as in frying or sautéing or given a long cooking when used as an ingredient in a sauce or casserole. If the squid pieces are to be quick-cooked, weight loss will be minimal (about 3-7 percent), and the meat will retain a characteristic snap or bite due to its turgidity. If the squid meat is to be boiled to achieve the desired end product, it will lose about 35-40 percent of its weight during the first five minutes of active boiling and up to 55 percent after 30 to 40 minutes. Squid meat should be taste-tested regularly for texture during prolonged cooking until the optimal degree or desired level of tenderness has been achieved and then served or processed immediately. Small squids are cooked a shorter time than larger ones. Overcooking should be avoided because the flesh will toughen or become gummy and friable, and will lose flavor.

In general, higher sensory acceptance scores were obtained when squid meat was prepared with its skin on, although to some members of our taste panel, the appearance of white, skinless flesh was more acceptable.

USES FOR SQUID WASTE

The sepia or ink of cephalopods has been refined and used as a colorant by artists for many years. It is also frozen and used as an ingredient in ethnic cephalopod cookery. Japanese researchers have been studying means of extracting a high viscosity glue from squid skin (Nakamura and Kitabayashi, 1964). When properly processed, a high grade nitrogenous fertilizer or animal feed supplement can be made from the viscera and "pen" which comprise 20-40 per cent of the animal's weight. Squids not suitable for human consumption can be similarly treated.

FISHERY PROBLEMS

The problems that arise in the development of a stable squid fishery are many. As noted, data are needed on the biomass distribution, biology, the reproduction and life cycle patterns, and migrations of all the utilizable species of squid. Existing fishing gear and methods for an expanding inshore fishery can be refined as demand increases, but new methods of locating, herding, and capturing less accessible oceanic squids should be developed. For instance, research on the effect of continued or pulsed, mono or polychromatic illumination, as mentioned by Zuev and Nesis (1971), to attract squid could be researched more intensively. The use of acoustics and the potential of electrofishing for squid should be investigated.

The development of automated mechanical means of completely processing squid, either aboard ship or ashore, is desirable from the standpoint of efficiency and cost reduction.

A constant and reliable source of supply of squid is essential for the development of a stable fishery. Maximum sustainable yield per species and area should be determined and overfishing avoided. At this time, especially in the United States, an intensive promotional and marketing effort is needed. A market for squid should be created and developed in areas where, at present, none exists. If this were done, the latent world squid resource could materially add to the world's portein supply. Much has been written in this same vein for many years, but it seems clear that now, in this period when more abundant food resources are urgently needed, is the time for concerted action for the utilization of squid in the United States.

ACKNOWLEDGMENT

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Financial Assistance to Tuna Vessels in IATTC Regulated Area Is Restricted

Until further notice the National Oceanic and Atmospheric Administration will not provide financial assistance that would significantly increase the harvesting capacity of vessels in the yellowfin tuna fishery in an area of the Pacific regulated by the Inter-American Tropical Tuna Commission (IATTC), of which the United States is a member. The regulated area is roughly two and one-half times the size of the land mass of the contiguous 48 States.

The Commerce Department agency has declared the yellowfin tuna fishery in the regulated area a "conditional fishery," which is defined in Commerce Department regulations as a fishery where there are already more than enough vessels to harvest the available catch. The restriction on financial assistance is automatic upon such a declaration. The restrictions differ for each financial assistance program and are defined in the regulations covering the individual program.

Two financial assistance programs affected by this action are currently administered by NOAA's National Marine Fisheries Service—the Fishing Vessel Obligation Guarantee Program and the Fishing Vessel Capital Construction Fund Program. The first program provides a Federal guarantee for obligations, financing, or refinancing (for up to 15 years) 75 percent of the cost of constructing, reconstructing, or reconditioning U.S. commercial fishing vessels of at least five net tons. The second program is one under which Federal income taxes on fishing vessel income may be deferred in connection with constructing, reconstructing, or under certain conditions, acquiring U.S. commercial fishing vessels of at least five net tons.

NMFS Director Robert W. Schoning said that one of the goals of the Service is to administer its financial assistance programs in such a way that, on balance, the programs will be consistent with the needs and objectives of sound resource management, thus helping achieve one of the primary objectives of the Service—a viable U.S. fishing industry. Schoning said that the decision concerning the conditional fishery was reached after consideration of all comments received from the interested public and other agency officials which were solicited earlier this year. The official announcement of the new policy was published in the Federal Register 10 July 1974.

Whale Watching Grows to Be a Big Business

December again opens Southern California's unique winter pastime—whale watching—now confirmed to be a million-dollar-plus business by the Commerce Department's National Oceanic and Atmospheric Administration.

Each year between December and March gray whales, *Eschrictius robustus*, move from the Bering Sea to their Baja California breeding and nursery grounds. This annual southward migration close to the California coast has, over the years, generated considerable spectator interest.

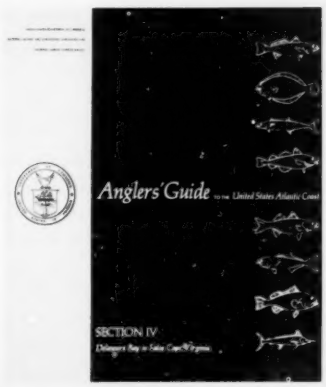
In a survey of various boat and landing operators early this year, biologists with NOAA's National Marine Fisheries Service discovered that about 115,000 enthusiasts spent some $750,000 for several hundred whale watching cruises on 27 boats between December 1973 and March 1974. Another estimated $200,000 was spent on such associated items as food, parking, transportation, and lodging, bringing total cruise expenditures to nearly $1,000,000. The additional daily tab for food, etc., at $1.75 per person, comes from a similar estimate used in the "1970 National Survey of Hunting and Fishing" and represents money that would not otherwise have been spent.

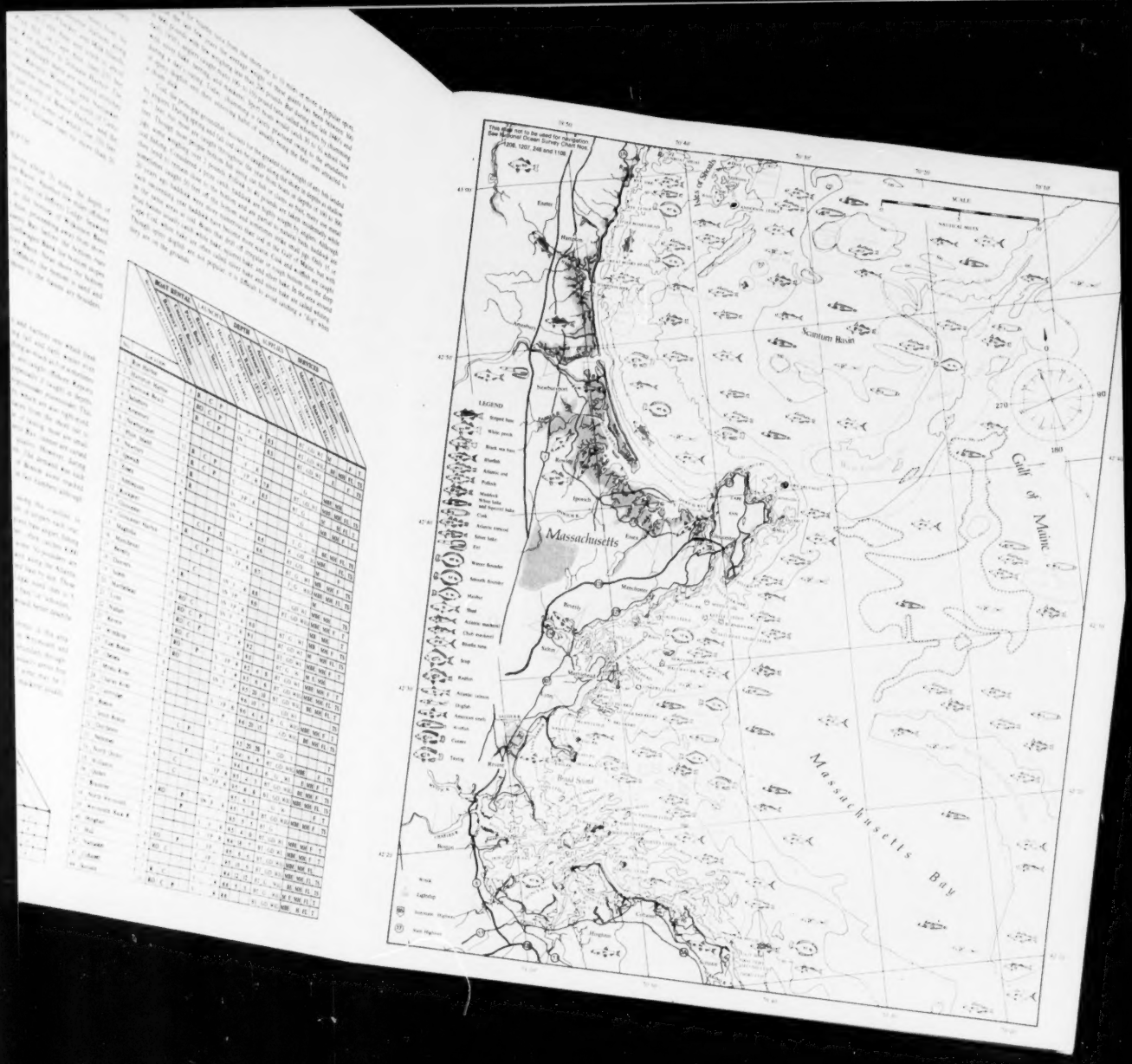
Whale watching activities at the Cabrillo National Monument, one of the areas where shore-based observations can be made, added another estimated $150,000 to the whale watching values, and brought the combined total to $1,100,000. While about 100,000 visitor-days are recorded monthly at Cabrillo National Monument, some 41,000 people attended a free movie on gray whales during the migration period. Estimating $2.00 per day for the net economic benefits associated with whale watching (a monetary projection derived from Water Resources Council guidelines on recreational values), and assuming the additional expenses of $1.75 per day for food, transportation, and lodging for the 41,000 visitors, the researchers calculated the $150,000 per year return from whale watching at Cabrillo National Monument.

The values measured are only estimates, the researchers point out, which in no way measures the public value associated with preserving the gray whale as a species. As measures of direct and indirect expenditures on whale watching cruises and shore-based whale watching values, however, the estimates are believed valid, though conservative.

U.S. Atlantic Coast Fishing Guide Issued

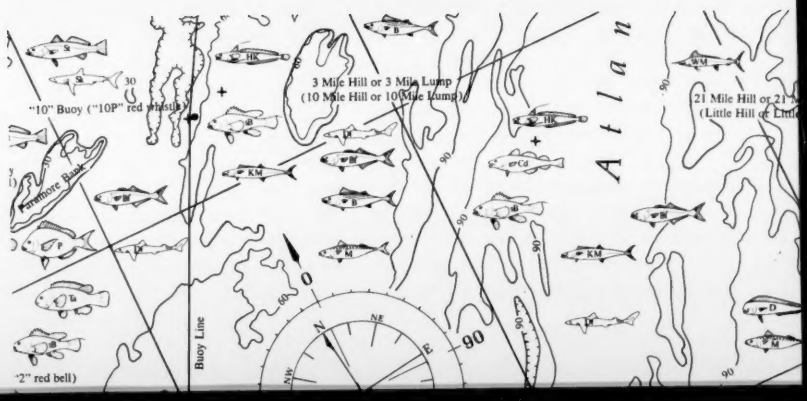
One of the most extensive and detailed marine sport fishing guides, "The Anglers' Guide to the United States Atlantic Coast," has been published by the Commerce Department's National Oceanic and Atmospheric Administration. Subtitled "Fish, Fishing Grounds, and Fishing Facilities," the 14 × 16½-inch guide thoroughly covers marine angling from Maine to Florida in eight separate 16 to 20-page sections. It was compiled by





NOAA's National Marine Fisheries Service in cooperation with many fishery biologists, State and Federal Agencies, sport and commercial fishermen, fishing facility operators, and others.

Detailed descriptions of the fish, fishing areas, and techniques are complemented by colorful, chart-sized maps which indicate the best fishing grounds and other land and oceanic



features of interest to sport fishermen. "Anglers' Guide" sections cover: Section I, Passamaquoddy Bay, Me. to Cape Cod, Mass.; Section II, Nantucket Shoals to Long Island Sound; Section III, Block Island, N.Y. to Cape May, N.J.; and Section IV, Delaware Bay to False Cape, Va. Sections I, II, and IV cost $4.15 each, and Section III costs $4.30. They can be ordered from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. Sections V-VIII will be printed soon.

The most common and popular sport fish in each section are described, including common and scientific names, and sizes: average; "unusually large"; largest; and the tackle record. Each species' preference for bottom type and depth, temperature, and information on the season caught and best fishing conditions are listed. Tips on the best fishing methods and the most popular and productive baits and lures are also given.

General arrival times of migrant sport fish are told as are other seasonal movements and the habits of year-round resident species. Ocean floor configuration is described along with general tide and weather conditions. Other items of interest include the effects that pollution, estuarine development, and overfishing have had on fish stocks and the marine sport fishery. Marine fishing is traced from earliest European exploration and colonization for most coastal sections and the decline of some of the fish stocks is noted.

Map features of interest to anglers include shoals, gullys, ledges, banks, wrecks, lightships, jettys, bars, reefs, channels, canyons, whistle buoys, and the like. Such land features as national and state parks, forests, wildlife areas, campsites, etc. are also shown. While the maps are not intended for navigational use, numbers of corresponding National Ocean Survey charts are listed for reference.

Tables keyed to each map provide extensive data on sport fishing facilities, supplies, and services. The number of boating facilities per location is given and available rentals are classed as rowboats, outboards, charter boats, party boats, runabouts, or skiffs. Launching ramps (surfaced or natural), and hoists (fixed or portable) are listed if available, as are marine railways. Tidal ranges, and approach and alongside depths are given in feet. Supplies and services mentioned include bait, tackle, gasoline or diesel fuel, water, ice, groceries, moorings, berths, electricity, motor or hull repairs, food, lodging, toilets, and showers. A 72-word glossary in each section defines words ranging from "Anadromous" to "Wet Fly."

Authors Bruce L. Freeman and Lionel A. Walford consulted extensively with commercial and sport fishermen, coastal wardens, outdoor writers, State and Federal fisheries biologists, and operators of marinas, bait and tackle shops, and boat liveries. Other important information was supplied by state park, forest, and recreation agencies as well as the National Park Service, and the U.S. Fish and Wildlife Service (formerly the U.S. Bureau of Sport Fisheries and Wildlife). The "Anglers' Guide" will be useful to most east coast saltwater sport fishermen.

Foreign Fishery Developments

Japanese Buy More U.S. Seafood in 1973

Japan's imports of seafood from the United States increased from US$25 million in 1972 to $89 million in 1973. This threefold increase boosted the U.S. share of the Japanese market from 4 percent in 1972 to 8 percent in 1973 and made the United States Japan's third largest supplier of fishery products after South Korea and Taiwan. This achievement is even more remarkable in view of the phenomenal surge in Japan's fishery imports which went from $618 million in 1972 to $1 billion in 1973.

Salmon was the most valuable U.S. seafood export sold to the Japanese in 1973; $29 million worth of salmon was exported, accounting for 70 percent of Japan's total salmon imports. Salmon roes ("ikura" and "sujiko" combined) were worth $26 million and accounted for a significant 71 percent of the Japanese market. Only a decade ago these valuable roes were being discarded as worthless. One of the most surprising developments in 1973 was the development of a sizeable tanner crab export industry. U.S. exports of tanner crabs to Japan went from $29,000 in 1972 to $14 million in 1973 and accounted for 67 percent of Japan's total imports of that species. U.S. herring roe exports were worth $5 million, but accounted for only 6.5 percent of the $77 million worth of herring roe imported by the Japanese during the year (by contrast, 100 percent of Japan's "herring roe on kelp" came from the United States, but this was worth less than $1 million). Frozen shrimp was the fifth most valuable seafood exported by (or transhipped through) the United States to Japan in 1973; $3 million worth of frozen shrimp was sent, but this accounted for only a minuscule 0.7 percent of the $432 million worth of shrimp bought by Japan in 1973.

Table 1 provides data on United States seafood exports to Japan in 1973 and shows the percentage each product held of the Japanese import market during the year. Table 2 pro-

Table 1.—The value of Japan's fishery imports from the United States as compared with Japan's total fishery imports, by selected fishery products, 1973

Product	United States	Total imports	Percent imported from the U.S.
	US$1,000		*Percent*
Abalone	491	4,359	11.3
Aquarium fish	352	2,492	14.1
Crab	14,011	20,866	67.1
Eel	37	38,535	.0
Elvers	66	15,163	.4
Herring	1,828	6,877	26.6
Herring roe	5,040	77,509	6.5
Herring roe on kelp	575	575	100.0
Salmon	29,168	41,191	70.8
Salmon roe (Ikura)	1,842	2,101	87.7
Salmon roe (Sujiko)	24,678	44,191	70.8
Scallops	62	4,359	1.4
Sea shells	1,256	2,634	47.7
Sea urchin roe	872	9,308	9.4
Shrimp	3,128	432,994	.7
Tunas			
Bluefin	1,678	3,563	47.1
Skipjack	3	1,745	.2
Yellowfin	11	18,859	.1
Other products	3,704	371,556	1.0
Total imports	88,802	1,099,173	8.1

SOURCE: Japanese Customs Returns.
Exchange Rate: 273 yen = US$1.00

Table 2.—The value of Japan's fishery imports from the United States, by selected commodities, 1964-73.

Commodity	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
						US$1,000				
Abalone	—	—	—	—	—	—	3	11	104	491
Aquarium fish	65	129	292	471	488	433	304	325	234	352
Crabs	—	—	—	—	—	—	29	34	29	14,011
Eels	—	—	—	—	—	—	—	—	—	37
Elvers	—	—	—	—	—	—	—	—	—	66
Herring	—	—	—	15	—	228	66	154	351	1,828
Herring roe	99	496	944	1,246	757	940	898	769	1,370	5,040
Herring roe on kelp	—	—	—	—	—	—	285	1,658	925	575
Salmon	2,225	427	878	902	1,187	7,932	4,561	5,128	2,214	29,168
Salmon roe (Ikura)	—	—	—	—	—	—	—	427	802	1,842
Salmon roe (Sujiko)	1,232	1,986	5,567	5,310	11,510	8,710	13,915	15,877	15,659	24,678
Scallops	—	—	—	—	—	—	—	427	802	1,842
Sea shells	1,429	3,480	8,759	4,217	1,222	1,715	1,299	274	735	1,256
Sea urchin roe	—	—	—	—	—	—	—	—	45	872
Shrimp	318	36	193	1,916	1,070	2,601	1,755	3,236	114	3,128
Tunas										
Bluefin	—	—	—	—	—	—	5	74	679	1,678
Skipjack	25	71	20	141	172	132	54	—	16	3
Yellowfin	—	—	—	—	—	—	—	91	71	11
Other	542	524	743	467	914	2,810	991	1,104	1,230	3,704
Total imports	5,935	7,149	17,396	14,685	17,320	25,501	24,165	29,162	24,578	88,802

Exchange Rates: Through 1970, US$1.00 = 360 yen; 1971, US$1.00 = 351 yen; 1972, US$1.00 = 308 yen; 1973, US$1.00 = 273 yen.
SOURCE: Japanese Customs Returns.

vides data on the total U.S. fishery exports to Japan for the period 1964-73.

Although 1973 was an exceptionally good year for U.S. fishery exporters selling to Japan, the situation in 1974 changed for the worse. According to Lorry M. Nakatsu, Regional Fisheries Attache in Tokyo, fisheries trade in 1973 was characterized by "frantic" buying on a world-wide scale, and "the market for imports went through wild gyrations, mainly upwards." This buying was stimulated, in part, by the strong position of the Japanese yen on world markets. However, beginning in late 1973, accelerated inflation and the tight financial market, aggravated by the Arab oil embargo, hit the Japanese market. Consumers faced by rapidly rising prices began to resist buying high-priced, luxury fish products—especially shrimp and salmon. With living costs spiraling upward, Japanese consumers became much more selective in their purchases, buying lower-priced fish and/or fish in season, such as frozen herring, saury, skipjack tuna, and sardines. The result was increased holdings of shrimp and salmon.

Japanese consumer resistance to high-priced, luxury seafood commodities was expected to continue through most of 1974. However, fishery imports were expected to remain at high levels due to the demand for seafood in Japan. Trade statistics for the period January-May 1974 showed that imports were 42 percent higher in terms of value and only 10 percent more in quantity as compared with 1973.

U.S. seafoods will, therefore, continue to find attractive markets in Japan, although certain luxury commodities may encounter short-term difficulties. The long-range outlook for U.S. seafoods is, however, excellent. The Japanese have already been faced with severe reductions in their high seas salmon and crab fisheries, and must therefore look to exporting nations for continued supplies of these seafoods. Additionally, the possibility of an internationally recognized 200-mile fisheries jurisdictional zone may greatly curtail Japan's high seas fisheries catch, further stimulating the demand for imported seafood products. U.S. seafood exporters can, therefore, expect excellent long-range opportunities for sales in the Japanese market.

Japan's Fish Exports To U.S. Are Listed

The United States has traditionally been Japan's best customer for its fishery products, and last year was no exception: US$226 million worth of Japanese tunas, mackerels, oysters, trout, and other seafood products were shipped to the United States in 1973. The United States market accounts for 35.5 percent of Japan's total fishery exports—almost six times more than Great Britain, Japan's second largest customer in 1973.

Table 1.—The value of Japan's fishery exports to the United States as compared with Japan's total fishery exports, by selected fishery products, 1973.

Product	United States	Total exports	Percent exported to the U.S.
	US$1,000		*Percent*
Crab, canned	106	1,153	9.2
Fish oil	7,106	10,469	67.9
Frog legs	2,018	2,050	98.4
Mackerel, canned	10,623	96,164	11.0
Oysters, canned	4,524	7,437	60.8
Pearls	7,850	65,446	12.0
Petfood	2,960	3,697	80.1
Rainbow trout	1,421	4,028	35.3
Salmon, canned	1,575	38,164	4.1
Shrimp, frozen	3,194	12,835	24.9
Swordfish	0	337	.0
Tuna, frozen	53,619	78,901	68.0
Tuna, canned	31,026	89,523	34.7
Other products	99,853	225,304	44.3
Total exports	225,875	635,508	35.5

Exchange Rate: 273 yen = US$1.00
Source: Japanese Customs Returns.

Frozen tuna exports to the United States were valued at $54 million in 1973. The United States purchased 68 percent of Japan's total exports of frozen tuna in 1973, making this seafood the leader in Japan's exports to this country. Canned tuna shipments dropped by around $18 million below 1972 shipments for a total value of $31 million (about 34.7 percent of Japan's total canned tuna exports). Canned mackerel (11 percent) exports totaled $10 million in 1973, making that product Japan's third most valuable seafood export. Japanese sales of pearls amounted to $7 million in 1973

Table 2.—The value of Japan's fishery exports to the United States, by selected commodities, 1964-73

Commodity	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
					US$1,000					
Crab, canned	5,348	4,354	2,796	2,435	5,285	6,315	3,810	6,265	2,591	106
Fish oil	14	—	—	12	—	—	1,412	6,915	4,455	7,106
Frog legs	—	1,248	1,426	1,343	1,370	1,922	212	1,037	1,201	2,018
Mackerel, canned	44	54	2,863	1,146	2,061	2,343	6,210	2,883	6,938	10,623
Oyster, canned	2,310	2,592	3,935	5,487	4,708	5,206	4,260	5,105	8,636	4,524
Pearls	21,115	23,697	23,371	17,399	12,533	11,495	9,378	6,601	7,276	7,850
Petfood	—	1,917	3,690	4,918	3,802	2,189	5,437	3,368	3,812	2,960
Rainbow trout	—	983	875	1,180	1,270	964	1,626	2,709	1,192	1,421
Salmon, canned	26	160	157	316	701	940	89	726	5,688	1,575
Shrimp, frozen	—	1,800	2,922	985	2,977	4,209	2,946	6,450	5,042	3,194
Swordfish	4,708	5,918	6,316	4,371	7,993	7,134	6,771	8	—	—
Tuna, frozen	20,045	16,558	27,945	13,600	16,806	9,840	14,083	14,066	33,351	53,619
Tuna, canned	20,852	18,251	25,131	26,884	29,297	36,240	42,988	34,256	49,393	31,026
Other	—	11,504	16,210	11,853	14,436	15,065	17,310	23,876	64,446	99,853
Total exports	n.a.	89,036	117,637	91,929	103,239	103,862	116,532	114,265	194,003	225,875

Exchange Rates: Through 1970, US$1.00 = 360 yen; 1971, US$1.00 = 351 yen; 1972, US$1.00 = 308 yen; 1973, US$1.00 = 273 yen.
SOURCE: Japanese Customs Returns.

(12 percent of their total exports), which is considerably below the $23 million worth of pearls shipped to the United States in 1965-66. Fish oil, canned oysters, frozen shrimp, petfood, frog legs, and canned salmon also ranked in the top ten, in terms of value, during 1973.

Table 1 provides details on Japan's exports of fishery products to the United States as compared with their total seafood exports for 1973. Table 2 provides data for Japan's seafood exports to the United States for the decade beginning in 1964.

Japanese Tell 1973 Fisheries Production

According to figures released recently by the Statistics Bureau of the Ministry of Agriculture and Forestry, Japanese fisheries production in 1973 totaled 10.7 million metric tons, an increase of 482,000 metric tons (5 percent) over 1972. Production by types of fisheries[1] are shown below.

Type of fisheries	[2]1972 (1,000 MT)	1973	Comparison (Percent)
High seas	3,905	3,937	+ 1
Offshore	3,588	3,940	+10
Coastal	1,907	1,855	− 3
Marine fisheries	9,400	9,732	+ 4
Marine culture	648	795	+23
Marine subtotal	10,048	10,527	+ 5
Inland water fisheries	109	115	+ 6
Inland water culture	56	53	− 5
Inland water subtotal	165	168	+ 2
Grand total	10,213	10,695	+ 5
Whaling (number)	14,590	11,801	−19

[1]SOURCE: *Suisan Tsushin* translation from U.S. Embassy, Tokyo.
[2]Excludes Okinawa Prefecture fisheries production.

New Shrimp Stocks Found off British Columbia

A significant expansion in the shrimp fishery off the central coast area of British Columbia could follow in the wake of recent discoveries by federal fisheries scientists, according to Environment Canada's Fisheries and Marine Service.

The fisheries research vessel *G.B. Reed*, operating out of the Fisheries and Marine Service's Pacific Biological Station at Nanaimo, B.C., conducted experimental trawls in late April 1974 that located about 150 square miles of productive shrimp grounds centered 30 miles southwest of Namu in Queen Charlotte Sound.

"This confirmed earlier predictions by our scientists working in conjunction with the Service's Industrial Development Branch, that appreciable new stocks might exist in the area" said Station Director Dr. W.E. Johnson. T.H. Butler, research scientist in charge of the Station's crustacean program, located major concentrations on the bottom between 90 and 110 fathoms. The shrimp were of good quality, averaging 120 to the pound. According to Mr. Butler, the present stock should permit a catch of about 5,000,000 lbs. per year, which at current prices would be worth about $750,000 to fishermen.

"There have been substantial increases in shrimp stocks along this coast in the past three to five years, and I would be surprised if additional concentrations were not found in more northerly British Columbia waters as well," Mr. Butler added. The new resources on the central coast follow similar finds last year by the two-man team of Butler and his technical assistant, Nelson Yates, on the west coast of Vancouver Island. The B.C. Packers fish plant at Namu has installed new mechanical shrimp peelers to cope with the expected expansion of the local fishery.

Canada Alarmed Over Foreign Capelin Take

Canadian Fisheries Minister Jack Davis called in June for an immediate end to large-scale Soviet and Norwegian fisheries which threaten capelin

runs to inshore areas along the Newfoundland coast. The Soviet and Norwegian fisheries operate in conformity with regulations of the International Commission for the Northwest Atlantic Fisheries (ICNAF) which involve quotas on stocks over broad areas. However, Mr. Davis pointed out that "a problem has been created by the foreign fleets concentrating in a small area very close to shore and fishing a vulnerable segment of a stock of special importance to our hard-pressed inshore fishermen."

A shift toward shore in Soviet and Norwegian fishing activity between 1973 and 1974 has resulted in an increased take of capelin stocks which migrate into the bays of Newfoundland where they are fished by Canadians and where they are a vital food source for cod and other valuable species. Canadian fisheries patrol vessels participating in the ICNAF joint enforcement scheme reported that more than 50 Soviet fishing vessels had been operating within 30 miles of the Newfoundland coast and as late as 1 June six more large vessels had joined the Soviet fleet. Seven Norwegian catching vessels had been fishing just outside the Canadian 12-mile limit off Trepassey Bay.

Last year the fishery did not pose the same threat to Canadian inshore fisheries because it concentrated on capelin spawning on the southeast edge of the Grand Banks over 200 miles offshore. Capelin in these offshore areas do not migrate inshore and because most of them die after spawning, have no value as food for cod. With regard to the new situation which has arisen this year the Minister instructed Canadian negotiators at the 24th annual meeting of ICNAF, which opened 4 June in Halifax, to make the strongest representations to officials of the Soviet Union and Norway attending the meeting for an immediate cessation to fishing for capelin in the sensitive areas close to shore. Mr. Davis said that he was hopeful that the matter could be resolved through negotiations during the ICNAF meeting.

"In view of the grave concern of inshore fishermen in Newfoundland and the Newfoundland fishing industry generally, if immediate action is not forthcoming Canada will consider what other measures may be taken to provide effective protection of the inshore capelin stocks. In the meantime Canadian patrol vessels and aircraft are continuing to inspect Soviet and Norwegian ships and are maintaining close surveillance over this fishery," Mr. Davis said.

Publications

Russian, Polish, Japanese, and Mexican Fisheries Books and Journals Translated

Eel culture, by Atsushi Usui, Midori Shobo Publishers, Tokyo, 1970, 79 p. Mr. Usui is president of the Shizuoka Tansui Freshwater Fish Farming Company. His book, long considered the best on Japanese eel culture techniques, is now available in English translation, revised and expanded to make it more meaningful to a Western audience. It includes a description of the world's species of *Anguilla* eels and a history of their culture, but the majority of the book is devoted to the practical aspects of eel culture. It covers catching of elvers, location of pond sites, construction of ponds, feeding, collection techniques and timing, prevention and cure of diseases, transport to market, and even the major methods of cooking eels.

Ichiro Hayashi of Tokai Regional Fisheries Research Laboratory in Tokyo prepared the original translation; Dr. Gordon Williamson, a British biologist who spent a year in Japan studying eels, has redrawn sketches and added to the text information on when and where to catch elvers in Europe, suitability of European climate to eel culture, species of *Anguilla* eels in Europe and the U.S., availability of supplies, and a comprehensive bibliography on eel culture. The excellent original set of figures has been expanded to include British and European subjects.

The translation, 186 p., is sufficiently comprehensive to provide a firm basis for new eel culture enterprises. It is available from Fishing News (Books) Ltd., 23 Rosemount Avenue, West Byfleet, Surrey, England, price about US$15.60 (6.75 English pounds) plus postage.

Biological and hydrological factors of local movements of fish in reservoirs, edited by B. S. Kuzin, Proceedings of Institute of Biology of Inland Waters, No. 16(19), Academy of Sciences of the USSR, "Nauka" Publishers, Leningrad, 1968, 277 p. This is a collection of 16 articles covering a wide range of factors affecting fish movement in reservoirs. The majority deal with studies conducted in the Rybinsk reservoir and include reservoir morphology, bottom sediment content, fish species composition, population dynamics, feeding habits, and species interaction. Other studies cover characteristics and dynamics of water masses in reservoirs, and particularly turbulent exchange, electroconductivity, temperature, and current velocity measurement.

The collection was translated from Russian by Amerind Publishing Co., New Delhi, India, for the Fish and Wildlife Service, U.S. Department of the Interior, under the Special Foreign Currency Science Information Program (financed with Public Law 480 funds). The translation, 389 p., is available from the National Technical Information Service, Springfield, VA 22151, price $8.25. Cite the translation's accession number, TT 71-58014, when ordering. A limited number of free copies is available from the Language Services Division, Office of International Fisheries, F43, NMFS, NOAA, U.S. Department of Commerce, Washington, DC 20235.

Oxyuroidea of animals and man, by K. I. Skrjabin, et al. Essentials of Nematodology, Vol. 8, Academy of Sciences of the USSR, Moscow, 1960, 280 figs., 531 p. This is a comprehensive study of the morphology, biology, ecology, and geography of Oxyuroidea, one of five superfamilies of Oxyurata, a suborder of parasitic nematodes.

The book contains a brief history and state of the art of the study of Oxyurata as well.

The translation, 280 figs., 625 p., was produced by the Israel Program for Scientific Translations (IPST) and is available from Keter Publishing House Jerusalem, Ltd., P.O. Box 7145, Jerusalem, Israel, or International Scholarly Book Services, P.O. Box 4347, Portland, OR 97208, price $40.00.

Fisheries exploitation of resources of the oceans, by M. S. Pavlov, et al, Central Scientific Research Institute for Information and Technical-Economic Studies of Fisheries (TSIITEIRKh), Reviews of Information, Series I, No. 4, Moscow, 1971, 46 p. The Moscow institute has issued a paper analyzing current catch data and delineating fish stocks with development potential in all the major fishing regions of the world. It considers FAO estimates of total ocean productivity to be low, as they do not take into account the potential use of phytoplankton, zooplankton, and algae; these could add 150-200 million tons to FAO and other estimates of 60-200 million tons per year. The paper points out, however, that plankton and algae harvest require significantly different technology. At present, cephalopods, in particular coastal squid, can provide the major feasible increase in catch.

In spite of obvious depletion of traditional stocks in the North Atlantic and Pacific, the paper sees the possibility of increased catches in all areas of the world's oceans through development of underutilized stocks. Soviet catches in the Northeast Atlantic have increased recently through additional catches of blue whiting and Arctic cod; other stocks suggested for exploitation were capelin, grenadier, argentine, silver hake, lanternfish, sand lance, Atlantic saury, and sea robin. The Pacific saury, cod, walleye pollock, and anchovy were open to greater Soviet exploitation in the Northeast Pacific, and squid and saury in the Northwest Pacific.

The Indian Ocean has the greatest potential for fishery development: the current catch of approximately 2 million tons might be increased tenfold by the end of the century. Catches of tuna, mackerel, and other pelagic species south of Java, in the Northwest Arabian Sea and Gulf of Aden, and at the equatorial upwelling might increase fivefold. Inshore and coastal fisheries of the Indian Ocean also have great potential productivity. Stocks such as squid off New Zealand and Moroccan herring in the Central Atlantic were also mentioned as having potential for development. The translation, 35 p., includes an extensive bibliography and is available on loan from the Translation Program, International Activities Staff, Fx4, NMFS, NOAA, U.S. Department of Commerce, Washington, DC 20235.

Theoretical premises for construction of an information system for economic evaluation of fish resources in the Atlantic Ocean, by V. V. Ivchenko, Proceedings of the Atlantic Scientific Research Institute of Marine Fisheries and Oceanography (Atlant-NIRO), No. 33, Kaliningrad, 1971, p. 11-18. This article discusses the need for and basis to a systems analysis approach to economic exploitation of fisheries resources, particularly in the Atlantic Ocean. It defines economic evaluation of fish resources of a particular fishing ground as "the determination of their value compared to resources of other grounds, calculated according to the system of economic indexes." Economic efficiency of exploitation is a major criterion. Two possible information systems for the Atlantic Ocean fisheries are described and discussed. The translation, 7 p., is available on loan from the Translation Program, International Activities Staff, Fx4, NMFS, NOAA, U.S. Department of Commerce, Washington, DC 20235.

Life cycle and dispersion of *Euphausia superba* Dana, by R. R. Makarov, and **Geographical distribution of spiny lobsters and ecological factors determining their commercial concentrations**, by V. I. Chekunova, in "Wealth of the World Ocean," No. 2, Proceedings of the All-Union Scientific Research Institute of Marine Fisheries and Oceanography (VNIRO), Vol. 77, Moscow, 1972, p. 85-92 and p. 110-119. The first article reviews what is known of the life cycle of Antarctic krill and describes the distribution of krill, particularly in the Weddell Sea, as observed by Soviet vessels from 1967 to 1969. The second article describes the variety and size of catches of the genera *Palinurus*, *Panulirus*, and *Jasus* in certain ocean regions and the biological bases for their commercial concentration. Total catches in tropical regions, where the greatest number of spiny lobster species exist, amount to 21,000 tons annually; the southern temperate region yields 36,000 tons per year. A lesser amount is harvested in northern temperate regions. Spiny lobsters, as members of well-balanced communities, are relatively unproductive crustaceans. They require constant, relatively closed-water circulation on a shelf area to form commercial concentrations, and such concentrations occur only among a few species. The two translations are available on loan from the Translation Program, International Activities Staff, Fx4, NMFS, NOAA, U.S. Department of Commerce, Washington, DC 20235.

The development of pisciculture in Cuba, by Yu. A. Privezentsev, in "Soviet-Cuban Fisheries Research," No. 3, All-Union Scientific Research Institute of Marine Fisheries and Oceanography (VNIRO) and (jointly) Center of Fisheries Research of the National Fisheries Research Institute of Cuba (TsRI), Havana, 1971, p. 111-116. Cuba is planning fish-breeding ponds in conjunction with reservoirs for irrigation according to VNIRO. Recent studies of inland water quality by an existing pond station and the Institute of Biology of the Cuban Academy of Sciences have made possible planning for development of aquaculture at several reservoirs, marshes, and rice paddies. Native populations of largemouth bass may be suitable for culture, as well as common carp, grass carp, and silver carp, all introduced from the USSR. Preliminary breeding results are described as encouraging. The translation is available on loan from the Translation Program, International Activities Staff, Fx4, NMFS,

NOAA, U.S. Department of Commerce, Washington, DC 20235.

Some problems of the biology of tunas in the Indian Ocean, by B. S. Solov'ev and B. N. Kuzmin, in "Current State of Biological Productivity and Living Resources of the World Ocean and Prospects of their Exploitation," Atlantic Scientific Research Institute of Marine Fisheries and Oceanography (AtlantNIRO), Kaliningrad, 1970, p. 230-238. AtlantNIRO has been gathering data on biological productivity and commercial concentrations of tuna in the Indian Ocean. This article summarizes data from 1966 to 1969, for the region bounded by 8°N and 5°S latitudes and from the eastern coast of Africa to 60°E, and southwest to 13°S latitude and the western coast of Madagascar. Bathythermograph probes to 200 meters were made where longlining is conducted. Yellowfin tuna were observed at depths of 131-180 meters; bigeye tuna were found at 222-253 meters. The study concluded that research into the biology and distribution of squid, luminous anchovy, and lancetfish (the main food of tuna) will aid considerably in locating the tuna themselves. The translation is available on loan from the Translation Program, International Activities Staff, Fx4, NMFS, NOAA, U.S. Department of Commerce, Washington, DC 20235.

Biology and fisheries of common cephalopods of the Atlantic, by A. N. Vovk and Ch. M. Nigmatullin, in "Fisheries Research in the Atlantic Ocean," Proceedings of the Atlantic Scientific Research Institute of Marine Fisheries and Oceanography (AtlantNIRO), No. 42, Kaliningrad, 1972, p. 22-54; **On the possibilities of specialized fishery of low-value Atlantic fish for fish meal production**, by S. K. Bulanenkov, and **Present state and expected changes in raw material base of the trawl fishery in the Northwestern Atlantic**, by K. G. Konstantinov, in "Current State of Biological Productivity and Living Resources of the World Ocean and Prospects of their Exploitation," Atlantic Scientific Research Institute of Marine Fisheries and Oceanography (AtlantNIRO), Kaliningrad, 1970, p. 139-145 and p. 7-15.

Three documents from research institutes in the USSR on aspects of Atlantic fishery resources have been translated for the National Marine Fisheries Service. The first gives quite detailed descriptions of cephalopod species and their distribution throughout the Atlantic Ocean, as well as guidelines on freezing, storage, and utilization of cephalopod flesh products. The resources of the southeast Atlantic are least known, but estimates have been made that the current total Atlantic cephalopod catch of approximately 1 million tons can be increased to 20 million tons. The second article discusses some of the problems of Soviet entry into fish meal production (most species suitable for fish meal are within territorial waters of other nations). The most productive area accessible to Soviet trawlers is along the western coast of Africa; in addition, sea robin, dogfish, anglerfish, and skate in the Northwest Atlantic could provide the basis for a sizeable fish meal industry. Other stocks, such as lanternfish, could be developed with medium trawlers fishing with lights. The third article describes stock conditions in the Northwest Atlantic by area and predicts Soviet catches in the years immediately following 1970. The translations are available on loan from the Translation Program, International Activities Staff, Fx4, NMFS, NOAA, U.S. Department of Commerce, Washington, DC 20235.

Shrimp fishery on the high sea and in the northwest: a biological/fishery analysis, by Daniel Lluch Belda, Secretariat of Business and Industry, Information Series INP/S1: 116, Mexico City, 1974, 78 p. This study, translated for the National Marine Fisheries Service, describes the state of the Baja California fishery for blue, white, and brown shrimp and discusses reasons for the recent decline in total harvest in that fishery. Reasons given include small mesh size of nets, excessive fishing effort and periods of poor growth of shrimp stocks. The study recommends 2½-inch mesh size of nets, seasonal protection of reproductive populations, and diversification of effort into the sardine, anchovy, and langostino fisheries. The translation, 73 p., is available on loan from the Language Services Division, Office of International Fisheries, F43, NMFS, NOAA, U.S. Department of Commerce, Washington, DC 20235.

Studies on demersal fish resources in East China Sea by tagging method, by Hideo Otaki, p. 73-97, in Report of Fishery Resource Investigations by Scientists of the Fisheries Agency, No. 12, 1971. This study, translated for the National Marine Fisheries Service, describes and evaluates results of experiments by the Japanese Government on red sea bream, conger eel, Korai shrimp, yellow croaker, and hairtail in the East China Sea. Stock size and movement were most successfully determined for red sea bream and Korai shrimp, but the more complex movements of hairtail and eels defied adequate delineation through tagging. The sensitivity of croaker to changes in pressure prevented the survival of a sufficient number of tagged individuals. These problems, as well as the more general problems—tag loss, lack of publicity, cost—of tagging research are discussed in detail. The translation, 52 p., is available on loan from the Language Services Division, Office of International Fisheries, F43, NMFS, NOAA, U.S. Department of Commerce, Washington, DC 20235.

A limited number of the following Russian and Polish publications translated and printed for the National Marine Fisheries Service under the Special Foreign Currency Program (financed with Public Law 480 funds) are available for free distribution from the Language Services Division, Office of International Fisheries, F43, NMFS, NOAA, U.S. Department of Commerce, Washington, DC 20235. Please request by translation number.

Translation number, titles, and authors include: TT 70-55125/3, 4, Marine Technology and Management, Vol. 20, Nos. 3, 4, 1970; TT 70-55125/7, Marine Technology and Management, Vol. 20, No. 7, 1970; TT 70-55126/3, 4, Shipbuilding, Vol. 15, No. 3, 4, 1970; TT 71-50026, The Living Resources of the World

Ocean, Moiseev, P. A.; TT 71-50032, Interpretation of Echograms of Hydroacoustic Fish-finding Instruments, Yudanov, K. I.; TT 71-50066, Marine Neustonology, Zaitsev, Yu. P.; TT 71-50111, Fertilization in Fishes and the Problem of Polyspermy, Ginzburg, A. S.; and TT 71-50127, Soviet Fisheries Investigations in the Northeastern Pacific, Part V (*Trudy VNIRO*, Vol. 70), Moiseev, P. A., (chief editor).

Vessel Finance, New England Fish Farms, Bottom Trawling Covered in URI Reports

Financing Fishing Vessels by Dr. Andreas A. Holmsen, published by the University of Rhode Island Sea Grant Program explains the roles of commercial banks, the Small Business Administration, the Farm Credit Administration and Production Credit Associations in financing new and used fishing vessels. Other finance programs explained are the Obligation Guarantee Program, a loan program operated by the National Marine Fisheries Service, and the Capital Construction Fund. Copies of "Financing Fishing Vessels," publication P343 are free from the Marine Advisory Service, University of Rhode Island, Narragansett Bay Campus, Narragansett, RI 02882.

Fish farming should be encouraged in New England by making specific coastal areas available to private concerns under long-term leases, and by conditional government assistance to fish farming enterprises, according to the report **Aquaculture in New England**, recently published by the University of Rhode Island Sea Grant program. The authors are Dr. John M. Gates, assistant professor of resource economics at URI, Clement S. Griscom, physical oceanographer for the Marine Experiment Station at URI, and G. C. Matthiessen, biologist, and president of the Marine Research Corp.

The authors said each state should make available not more than 1,000 acres of suitable coastal area that could be leased for fish farming for at least five years, but not more than 10. During this time they said, the economic feasibility of commercial fish farms could be explored. The 77-page report was the culmination of a three-year study funded by the New England Regional Commission, a federal-state agency comprised of the governors of the six New England states and a federal co-chairman appointed by the President, and the URI Sea Grant Program, which is supported by the National Oceanic and Atmospheric Administration. The researchers said the species appearing to have the greatest potential for fish farming in New England are the American oyster, hard clam, bay scallop, American lobster and silver (Coho) salmon, a Pacific species.

Copies (Marine Technical Report No. 18, p. 334) are available free of charge from the Marine Advisory Service, University of Rhode Island, Narragansett Bay Campus, Narragansett, RI 02882.

The factors that affect the performance of bottom trawl fishing nets are the subject of a report recently published by the University of Rhode Island Sea Grant program. Researchers Geoffrey A. Motte, Albert J. Hillier and Richard D. Beckwith changed, among other factors, the rigging of the *Yankee 35* bottom trawl for tests in Narragansett Bay with the URI research vessel, *Gail Ann*.

Captains Motte and Hillier are members of the department of fisheries and marine technology and Mr. Beckwith is a graduate student in ocean engineering, all at URI. They found that the opening of the mouth of the trawl was affected most by the number of headline floats used and the size of the net mesh. Although the experimental vessel used was small (47 ft long, with 96 hp), the authors said that the research produced information of interest to persons fishing from smaller inshore draggers. Some of the results, they said, may be applied to the entire series of Yankee trawls.

The report titled, **Bottom Trawl Measurement Trials Report**, is available free of charge. Requests for publication P312 should be mailed to the Marine Advisory Service, University of Rhode Island, Narragansett Bay Campus, Narragansett, RI 02882. A technical report of the trials may be obtained in the publication, **Bottom Trawl Performance Study**, at a cost of $1.50 for each copy. Requests mailed to the above address should stipulate P300. Payment must accompany orders.

University of Washington Sea Grant Books

A Hydroacoustic Data Acquisition and Digital Data Analysis System for the Assessment of Fish Stock Abundance by Edmund Pierce Nunnallee, Jr. describes a system designed and constructed at the University of Washington to measure the abundance of pelagic fish. The portable data acquisition unit consists of an echo sounder interfaced to a magnetic tape recorder. The digital data analysis unit incorporates a small computer, a line printer, and various hardware to interface the computer to an echo sounder or a tape player.

This paper was written to provide a basic operators manual for the hydroacoustic data acquisition and analysis system and to compile various publications relative to its use. General descriptions, instructions for use, and theory of operation are given for each major component of the system. Several methods for the analysis of recorded hydroacoustic data are also included. Single copies free, multiple copies are $1.00 each from Washington Sea Grant Communications Program, Division of Marine Resources, University of Washington HG-30, 3716 Brooklyn Ave., N.E., Seattle, WA 98195.

So You Bought a Boat! Practical Tips for the Mariner by Captain Robert E. Williams contains safety tips and hints on cruising. It provides useful information not normally found

in more conventional books on boating, and its intended use is for those chance occasions when the more usual systems are inoperative. There are helpful tips on how to avoid trouble and in some cases how to get out of trouble in the 40-page paperbound booklet.

The author based this pamphlet on over 20 years of experience with the National Ocean Survey and Coast and Geodetic Survey. Single copies are free (multiple copies cost $1.50 each) from the Division of Marine Resources, University of Washington HG-30, Seattle, WA 98195.

The **Atlas of Physical and Chemical Properties of Puget Sound and Its Approaches** by Eugene E. Collias, Noel McGary, and Clifford A. Barnes was planned to provide useful information for anyone making decisions based on physical and chemical characteristics of Puget Sound, and for anyone doing research on estuaries. Ocean engineers, commercial fishermen, fish farmers, regulatory agency personnel, and legislators are among those who will be interested in the data portrayed in this atlas.

The first readily available graphic description of Puget Sound water quality data over a sustained time period (1952-1966), the 235-page atlas includes the oceanographic parameters for vertical profiles along eight major channels of the Sound. The paperbound volume is available from the University of Washington Press, Seattle, WA 98195 for $15.00.

Letter

Editor:

I found the paper "Some ABC's of Fo'c'sle Living" (Marine Fisheries Review, June 1974) most informative as well as entertaining. It was obvious that the authors had experienced both the hardships and rewards of life at sea, for only "someone there" could describe them with such vigor and color.

But while my "editorial greed" was aroused I wasn't able to overlook a few items to "nitpick" about. These may be small details or simple misconceptions in my mind, but if valid they are important to a seaman.

On several occasions the authors refer to the "dock" as the physical structure to which one secures his vessel. This structure may be called the pier or wharf, if open piered, or the bulkhead, if it is a solid structure. "Dock" would refer to the space alongside a wharf that a ship occupies when tied up; or more commonly to a basin or enclosure for the reception of vessels and subsequent control of the water level (i.e., a graving dock or floating dry dock); or to the act of berthing a vessel. The word "dock" should be used to describe a piece of water, or a particular act of shiphandling, or a specialized structure but not the good ol' pier.

A vessel is not necessarily "underway" when she is "in forward motion, running, steaming"; she is "making way." A vessel is underway when she is not at anchor, or made fast to the shore, or aground and may indeed be underway, but not making way. These definitions are provided for in the nautical rules of the road and accepted by most seamen.

Finally, with regard to an anchor watch, I cannot agree with the definition that a bearing "is a compass reading on a very close landmark." Bearings, whether radar or visual, are best observed to landmarks or land tangents a good distance from the observer but sufficiently close to avoid their obscurity by weather. Bearings on objects at close range may change substantially as a vessel swings about her anchor causing undue alarm, but a watchstander will soon get the feel for how much a distant bearing may allowably change. In the absence of radar, a good range, and at least one cross bearing, will enable one to detect anchor drag.

The above comments should not detract in any way from the excellent essay written by Larssen and Jaeger. The authors have been going to sea for a longer period of time than I have been alive and it is from men such as these, who have both loved the sea and learned how to live with her, that younger men acquire their best knowledge. Any seaman, fisherman or merchant, should be indebted to someone who takes the time to pass on his experience.

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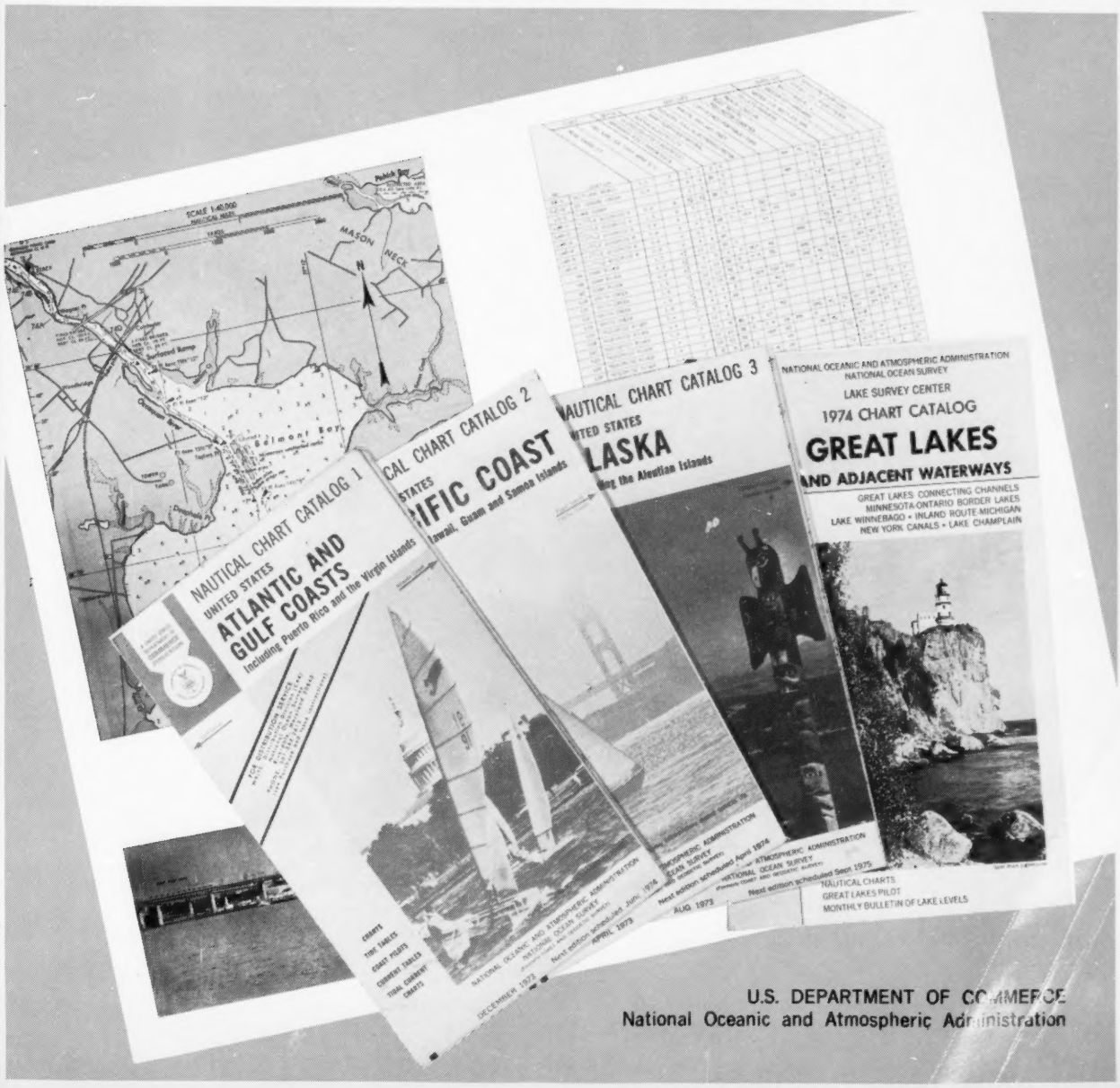

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